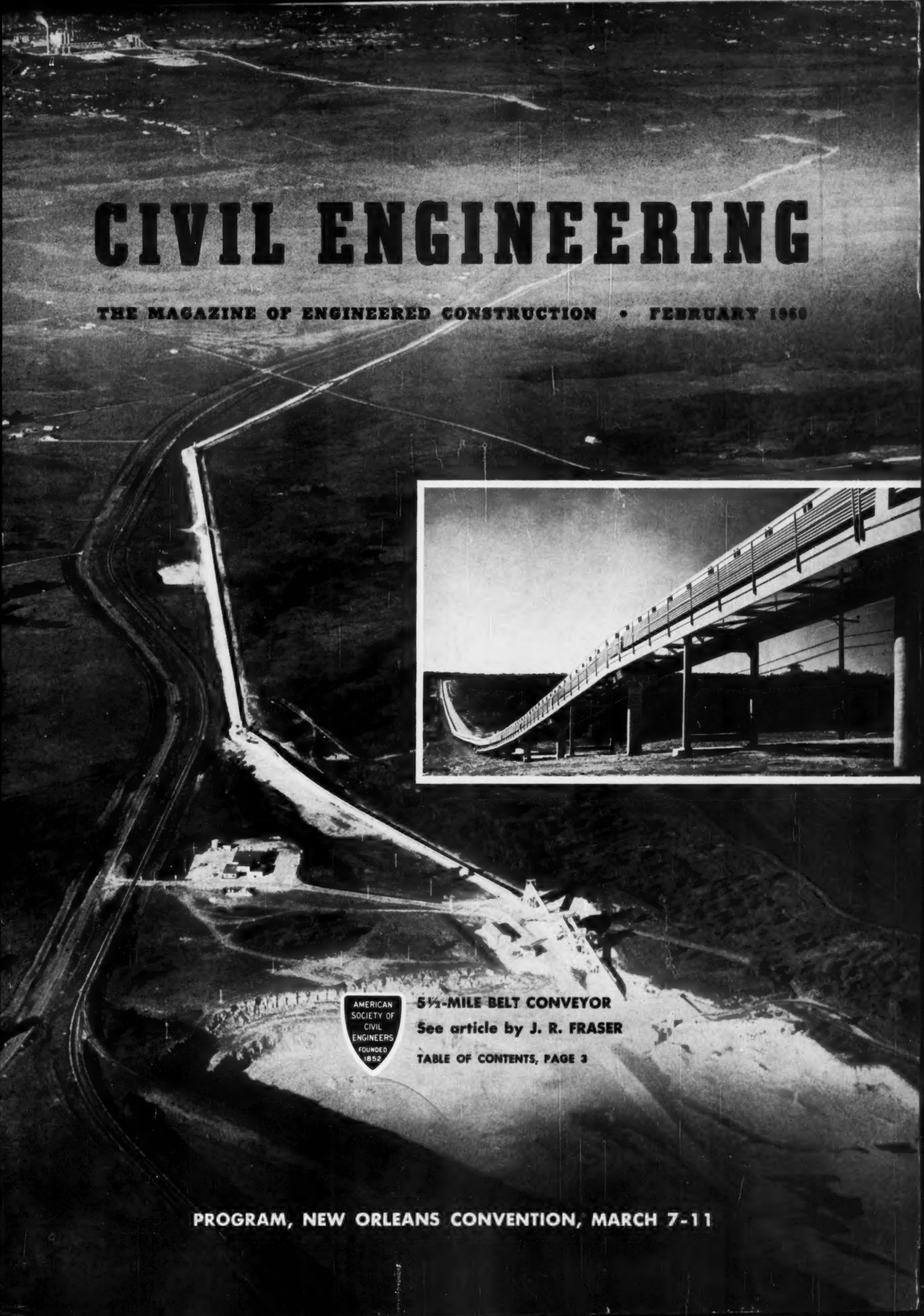
CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION • FEBRUARY 1960



AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

5½-MILE BELT CONVEYOR

See article by J. R. FRASER

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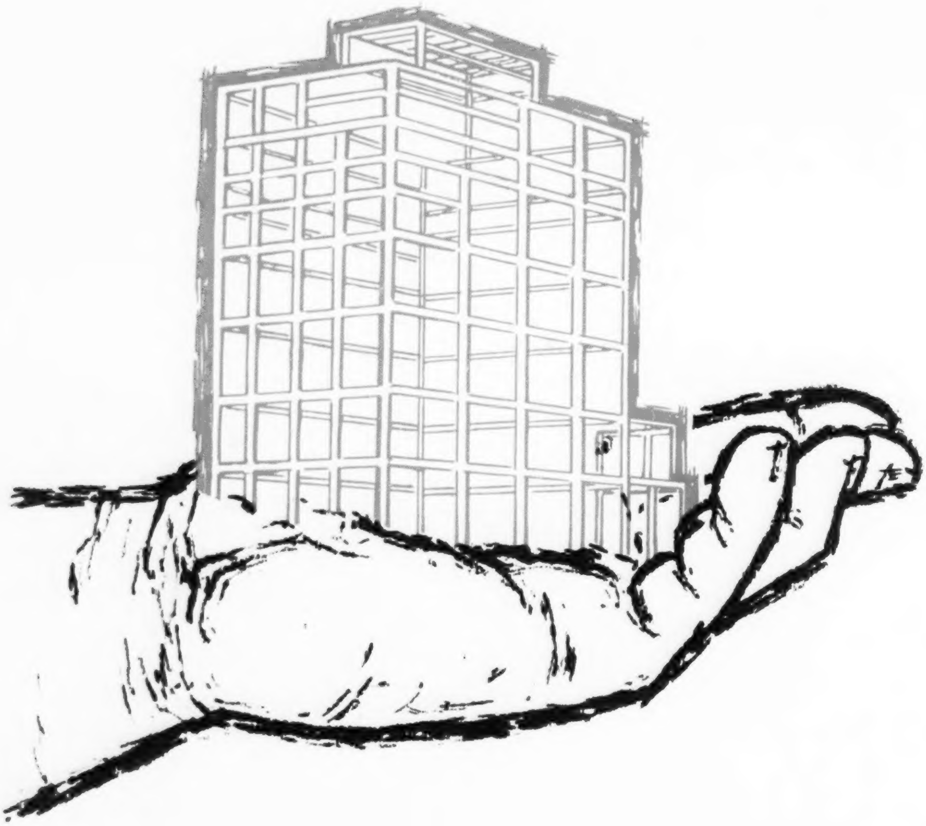
PROGRAM, NEW ORLEANS CONVENTION, MARCH 7-11



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CIVIL ENGINEERING

FEBRUARY 1960

VOL. 30 • NO. 2

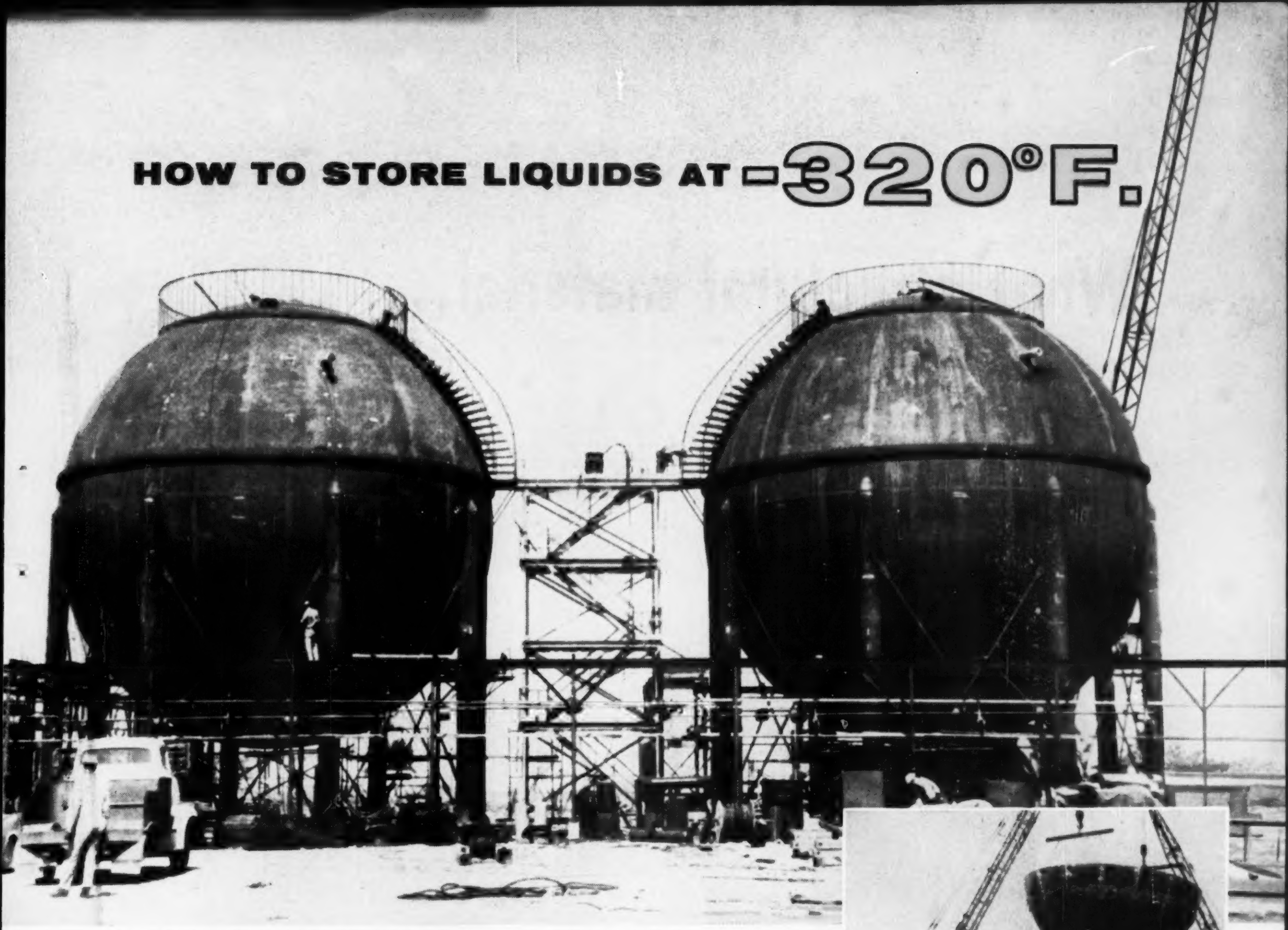
THE MAGAZINE OF ENGINEERED CONSTRUCTION

• ARTICLES

• ASCE NEWS

• DEPARTMENTS

HOW TO STORE LIQUIDS AT −320°F.



CB&I Hortonspheres built for cryogenic storage are spheres within spheres.

CB&I-built HORTONSPHERES® do it for Linde at Pittsburg, California

CB&I engineered, fabricated and erected these special Hortonspheres for Linde's new plant at Pittsburg, California, using Linde-approved designs. One is used to store liquid oxygen at −297° F. The other will store liquid nitrogen at −320° F.

Their construction is unusual . . . each structure is actually a sphere within a sphere. A specially designed rod support system cradles the 38′9″ diam. aluminum inner sphere within the 46′9″ diam. carbon steel outer shell. Heat transfer to the inner sphere is minimized by powdered insulation placed between the inner and outer shell.

Cryogenic storage calls for vessels of special design . . . and the know-how to build them. Linde Company used this know-how from CB&I's seven decades of craftsmanship in steel. So can your company. Write for further details.

C51CB

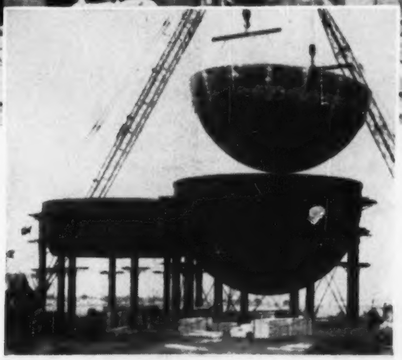
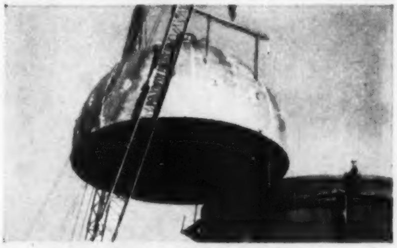
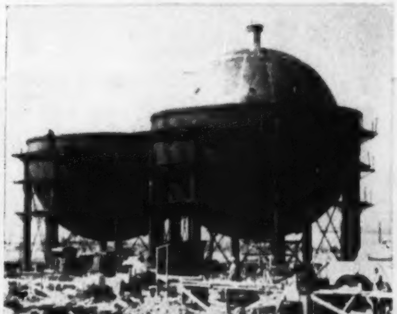


Photo taken during erection shows cranes setting section of aluminum inner sphere.



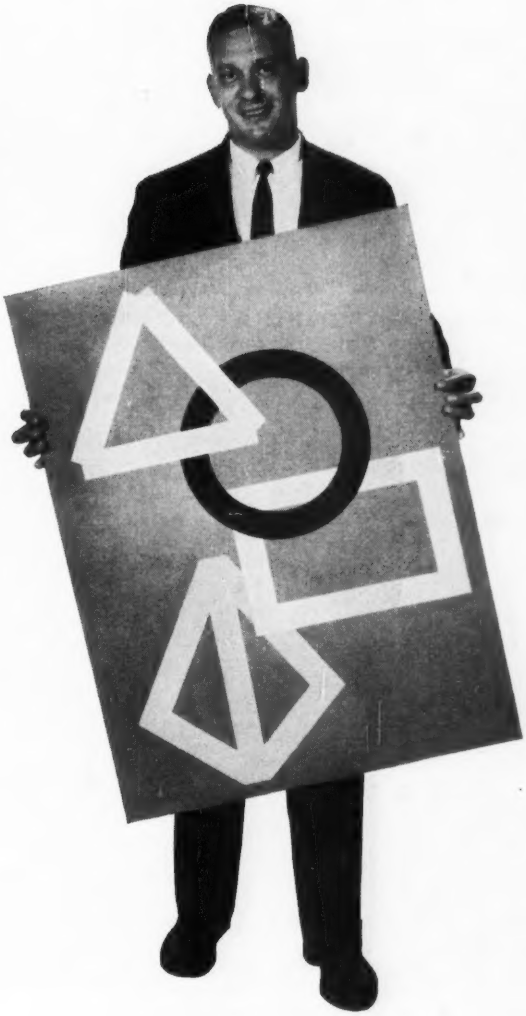
Above and below: Experienced CB&I erection crews make tough jobs look easy.

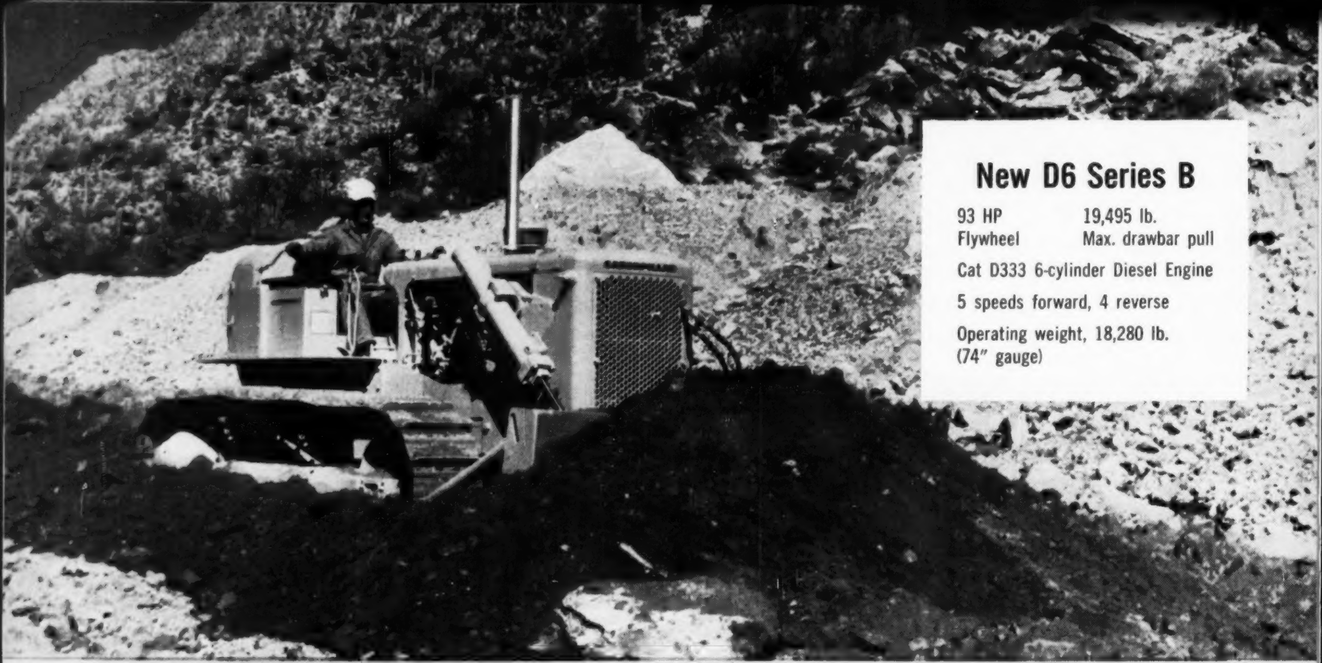


CHICAGO BRIDGE & IRON COMPANY

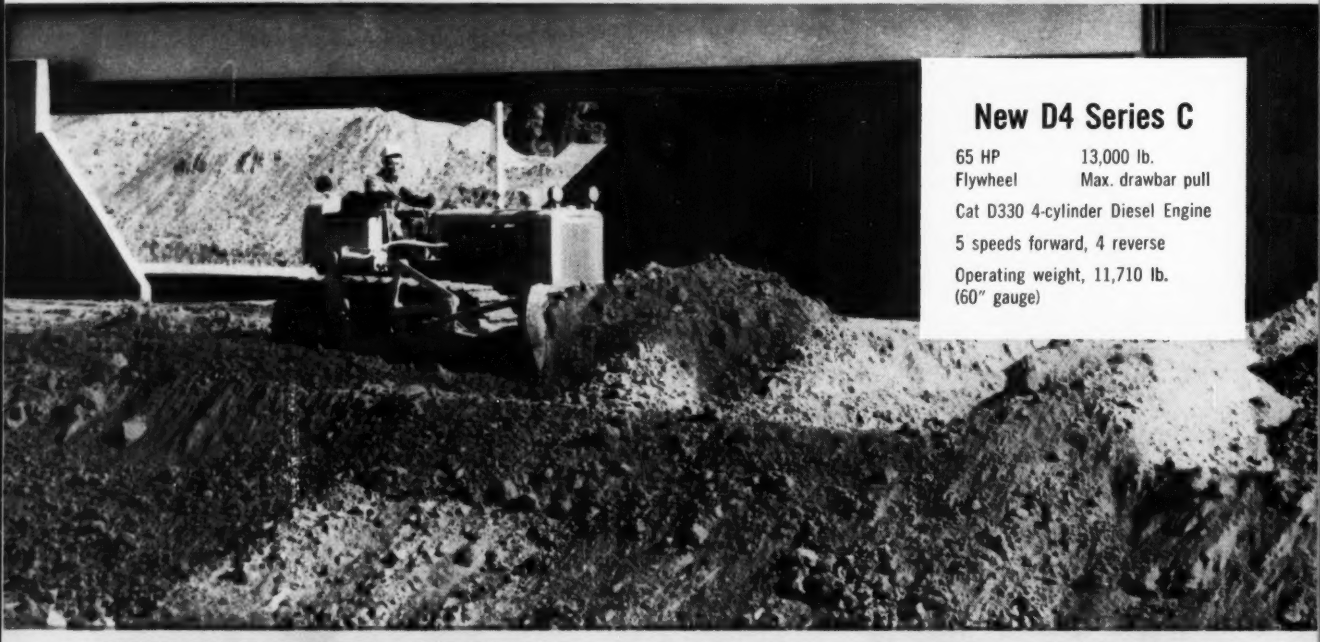
332 SOUTH MICHIGAN AVENUE
CHICAGO 4, ILLINOIS

OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD





RUGGED MATCHED ATTACHMENTS for the D6 and D4 include Bulldozers, Tool Bar, Scraper, Rock Rakes, Winches, K/G Blade, Rippers and others.

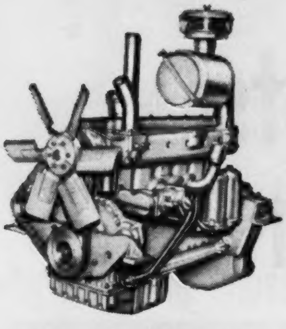


IMPROVED STARTING ENGINE for both tractors has recoil starter for fast starts. Also 12-volt in-seat starting available. 24-volt direct electric starting optional.

CATERPILLAR ANNOUNCES the

completely redesigned for faster and greater production

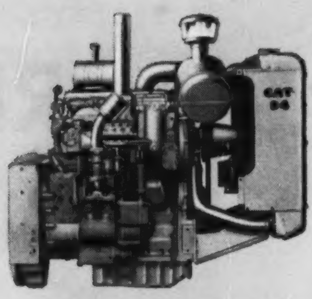
There's no time like now to upgrade your equipment spread. These two new tractors not only look different—they are different. Each, in its own class, answers your needs for higher production and greater operating economy. Some of their important new features are described on these pages. In addition to these improvements, each machine provides other famous Caterpillar features . . . the dry-type air cleaner,



D6 93 HP 6-cylinder Engine
Maximum drawbar pull, 19,495 lb. The D333 Engine provides power with dependability for a long life of economical operation.

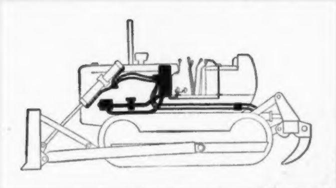
New Caterpillar Diesel Engines deliver 25% more lugging ability

For the D6 and D4, two completely new Cat Diesel Engines. 25% more lugging ability. New compactness with new ruggedness. Famous Cat fuel injection pumps in new, easily serviceable housing. New direct acting governor that makes quick fuel adjustments, picks up loads fast. New, improved gasoline starting engine.



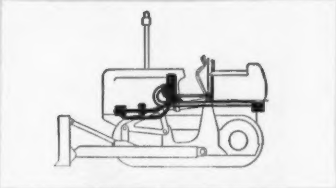
D4 65 HP 4-cylinder Engine
Maximum drawbar pull, 13,000 lb. New design of the D330 results in smooth, vibration-free performance in all speed ranges.

New integral hydraulic systems put more power where you need it

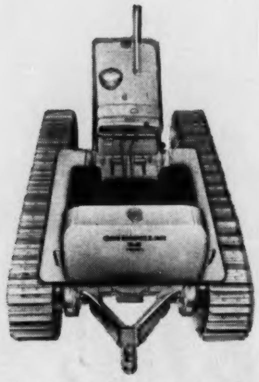


D6 Integral Hydraulic System
No. 165 Hydraulic Control for bulldozer
54 GPM Pump—1500 PSI
No. 143 Hydraulic Control for No. 6 Tool Bar
29 GPM Pump—1700 PSI

More work power at the tools—that's one of the big advantages of these new Cat hydraulic systems. Under-the-hood mounting of tank, pump and valves permits convenient routing of hydraulic lines to bulldozer or implement cylinders, frees front and rear for mounted equipment. Center-pivoted cylinder mounting on D6 gives increased blade lift/drop range for greater production. Hydraulic control system provides hand control for bulldozer and/or ripper, foot control for tilt cylinder on D6.



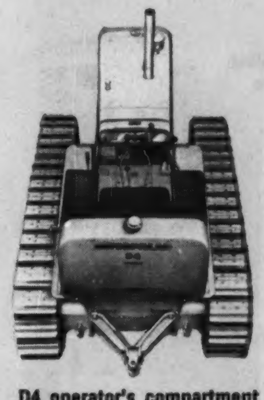
D4 Integral Hydraulic System
No. 143 Hydraulic Control with:
29 GPM Pump—1700 PSI for bulldozers
17 GPM Pump—1700 PSI for tool bars



D6 operator's compartment

New operator convenience and comfort in co-ordinated compartments

The cockpits are all new. Controls are coordinated to make one motion flow into the next, reducing hand movements and speeding every operation. Forward-reverse lever (new on the D4) is next to the operator's right hand to speed 'dozer cycle times. Short-travel transmission speed selector shifts gears easily, quickly. Boosters for steering clutches save muscles . . . increase efficiency.



D4 operator's compartment

New D4 Series C and D6 Series B Tractors

hydraulic track adjusters, lifetime lubricated track rollers, the oil clutch, the forward-reverse lever. Your Caterpillar Dealer will be happy to give you the complete facts about both the new D6 and the new D4 and demonstrate them on any of your jobs. The tougher, the better.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

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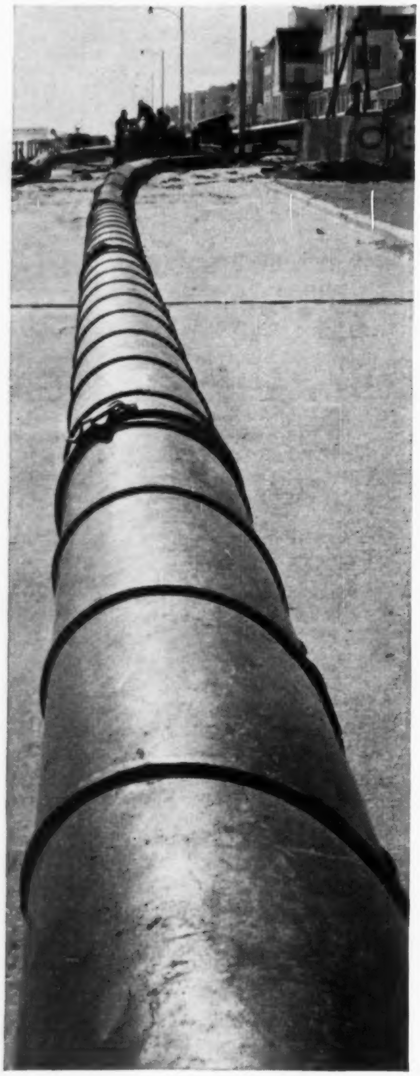
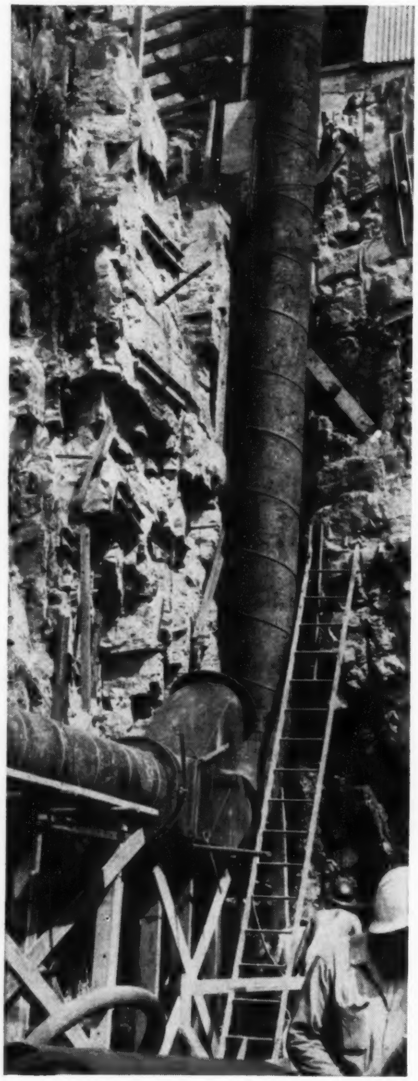
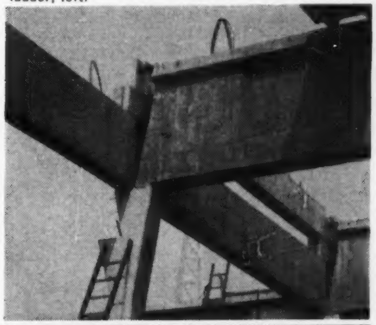
PROVED IN THE FIELD

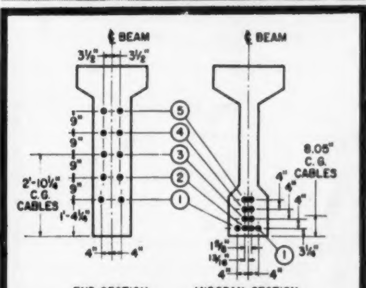




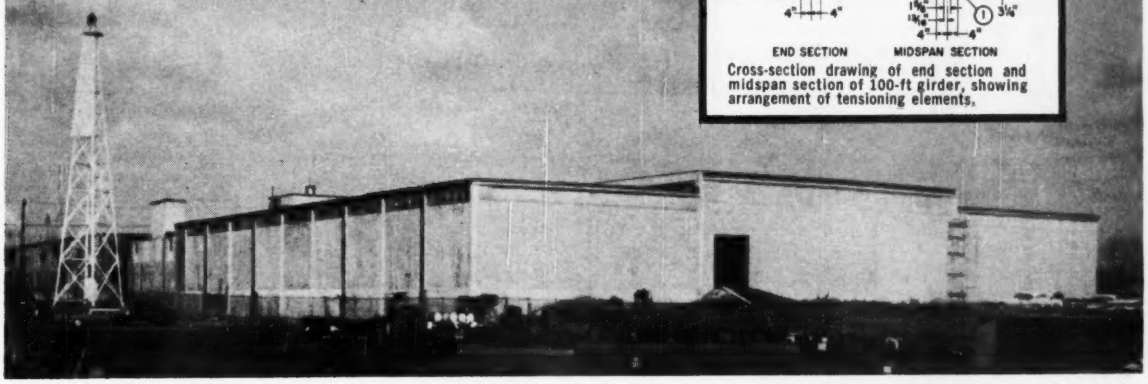
Architect-Engineer offers some impressive reasons why his firm chose Prestressed Concrete for Paper Storage Warehouse

Photo shows how 100-ft girder rests on column. End of 70-ft girder is positioned on seat seen at top of ladder, left.





Cross-section drawing of end section and midspan section of 100-ft girder, showing arrangement of tensioning elements.



Newman & Company Warehouse, embodying twelve 100-ft post-tensioned girders, twenty-two 70-ft post-tensioned girders and about 600 pre-tensioned double tee beams.
Architects and Engineers: Cronheim & Weger, Philadelphia, Pa. Contractor: Lauter Construction Company, Philadelphia, Pa. Prestressed Fabricators: Atlantic Prestressed Concrete Co., Trenton, New Jersey.

Because Nathan Cronheim, architect-engineer, has much to say about this structure, we quote him as follows: "The design of the new waste paper storage building for Newman & Company, Inc., manufacturers of paper board in Philadelphia, incorporates a number of relatively new techniques and processes in developing a more fire-resistant building and in expediting the handling of stored materials.

"The roof structure is composed of twelve 100-ft span and twenty-two 70-ft span post-tensioned girders. Each girder was post-tensioned with ten Freyssinet Cables composed of twelve .276" diameter Roebling wires. (See diagram). The approximately 600 double T's used in the roof structure are pre-tensioned, using the Roebling standard seven wire pretensioning strand. The great strengths resulting from this method allow the roof structure to be much shallower and lighter in weight than would be possible in other types of equally fire-resistant construction.

"The building is two hundred and forty-ft wide, made up of a center bay one hundred-ft wide and two side bays each seventy-ft wide. There are, therefore, girders one hundred-ft long in the center bay flanked on either side with girders seventy-ft long. Since the girders are spaced twenty-five ft on centers, the T's which span from girder to girder are almost twenty-five ft in length. As can be readily seen, due to the exceptionally long spans, it is necessary to use the higher strength materials mentioned to keep the dead weight of the roof structure to a minimum.

"Because of the prefabrication of so many of the elements of this building, such as the girders, roof plank, wall panels and many of the columns, the erection of the building moved very rapidly once the foundation work was completed."

Nothing makes a better case for the prestressed concrete method than the *architect's own words.* In all of the many years that Roebling has concerned itself with tensioning elements for prestressed concrete, we have found that its inherent benefits are best articulated by the architects and engineers who design for, and work with, prestressed concrete. During these years we have developed and accumulated a significant body of knowledge, data and experience that we will gladly share with you. An inquiry to Roebling's Construction Materials Division, Trenton 2, New Jersey, bearing on any phase of prestressed concrete, will bring a prompt and fully documented reply.

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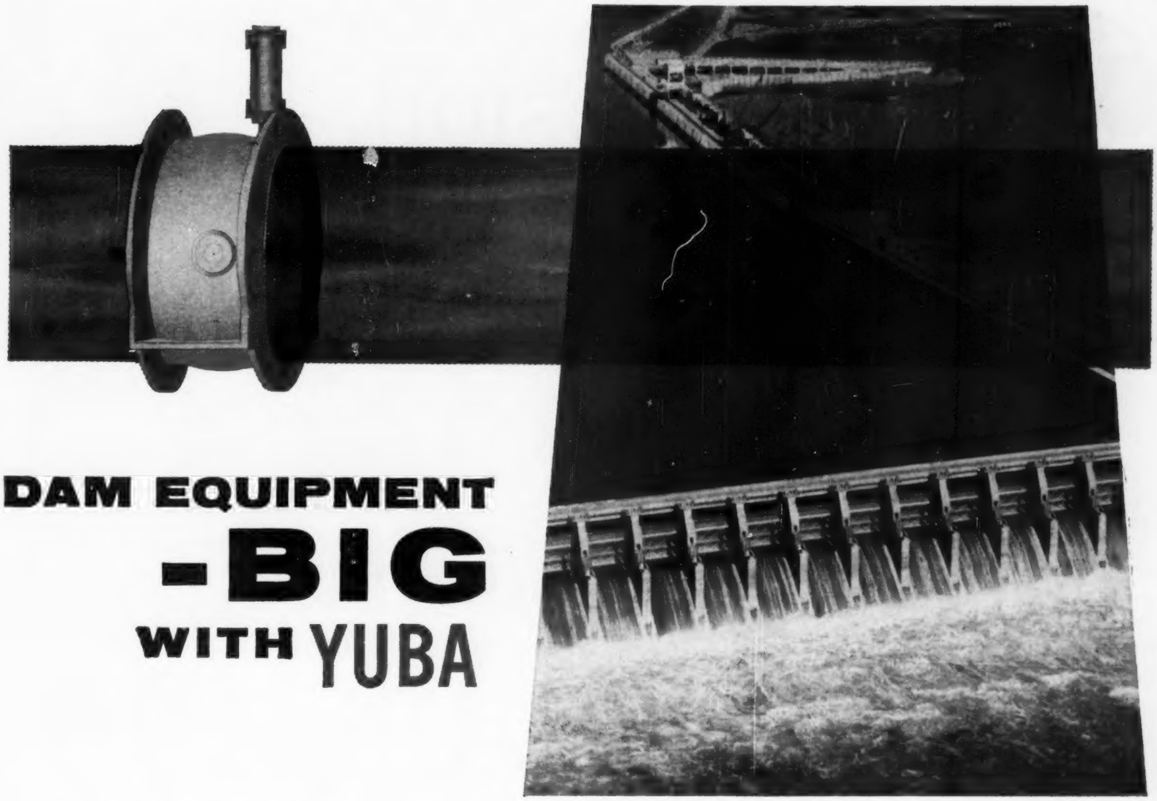

"No corrosion, negligible maintenance and continued high carrying capacity with Transite Pipe."

—F. A. Anderson and C. L. Johnson,
Johnson & Anderson, Inc., Pontiac, Mich.

"First cost and economical operation make Johns-Manville's Transite Pipe a practical long-term investment," say Messrs. Johnson and Anderson, consulting engineers, pictured at right. "Despite this economy its performance is superior in many ways. There's no corrosion, negligible maintenance and continued high carrying capacity . . . helping through the years to save in the operation of the system. These many economies make it easier for communities to build and expand their water systems."

Transite's maintained carrying capacity keeps pumping costs low. Its strength, durability and corrosion-resistance cut maintenance—provide years of trouble-free service. Further savings are effected by the sure coupling method that assures a tight seal at every joint. Add to this Transite's natural interior smoothness and you see why it helps reduce community water system costs. Let us send you "Facts and Data for Engineers" book. Write Johns-Manville, Box 14 (CE-2), New York 16, N. Y.

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Functioning on an interrogator-responder principle, Micro-Dist is easily operated after just a few minutes of familiarization training. Either station can serve as interrogator or responder, providing flexibility that permits "step-along" measurement and fast cross-check. Electronic surveying with the world's most advanced equipment – MICRO-DIST . . . the answer to *your* surveying problem.

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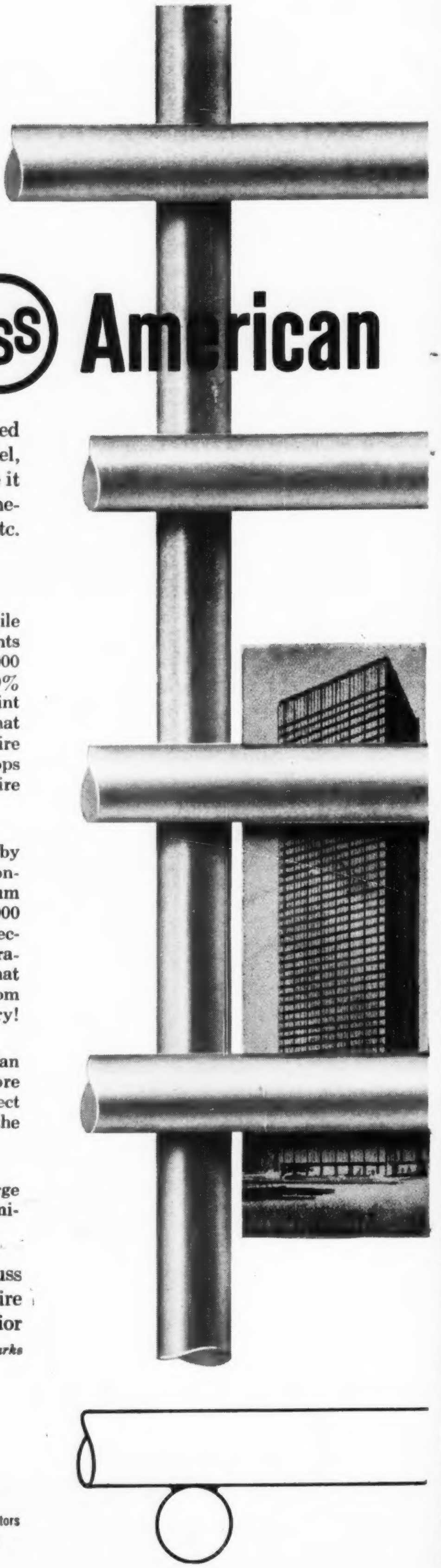
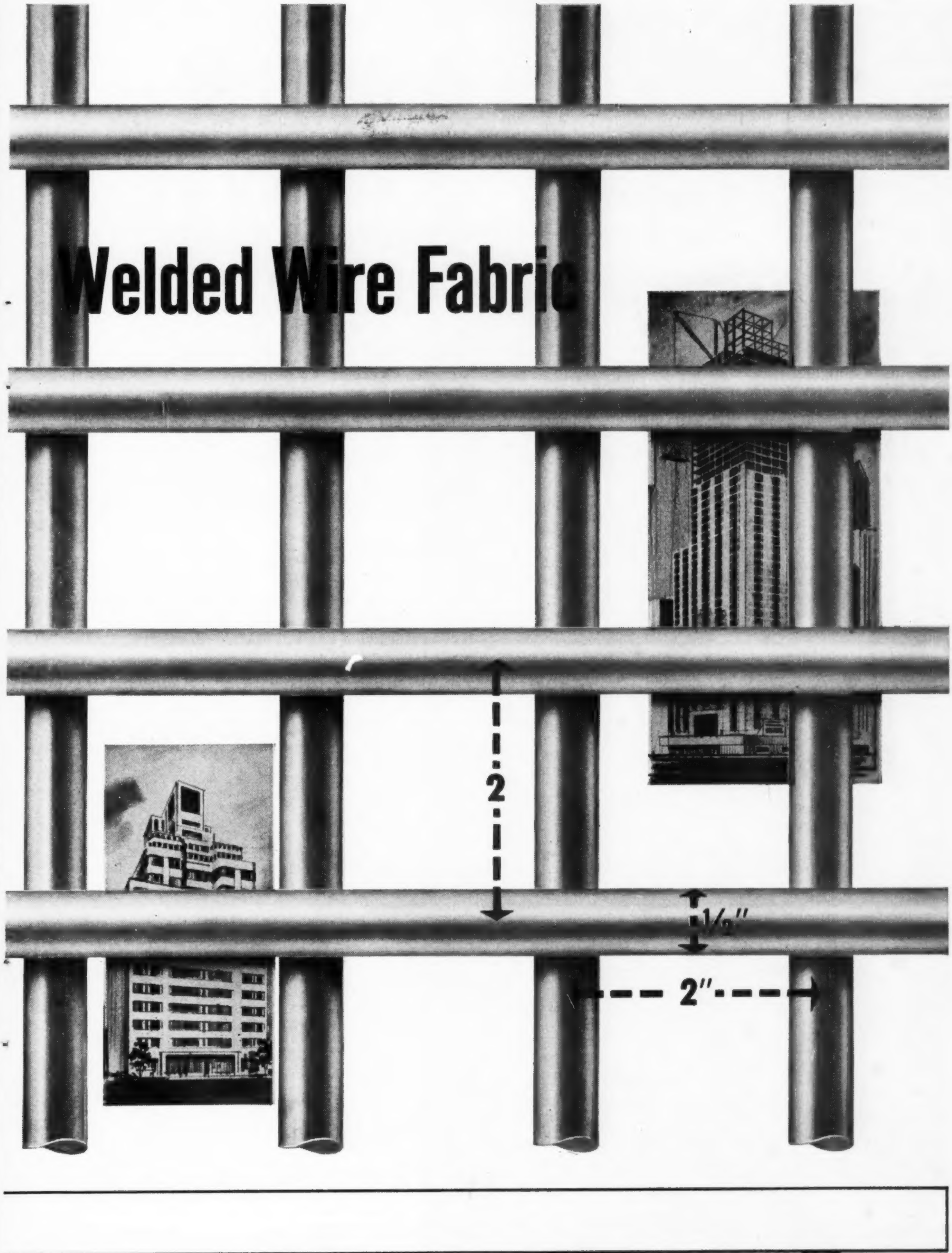


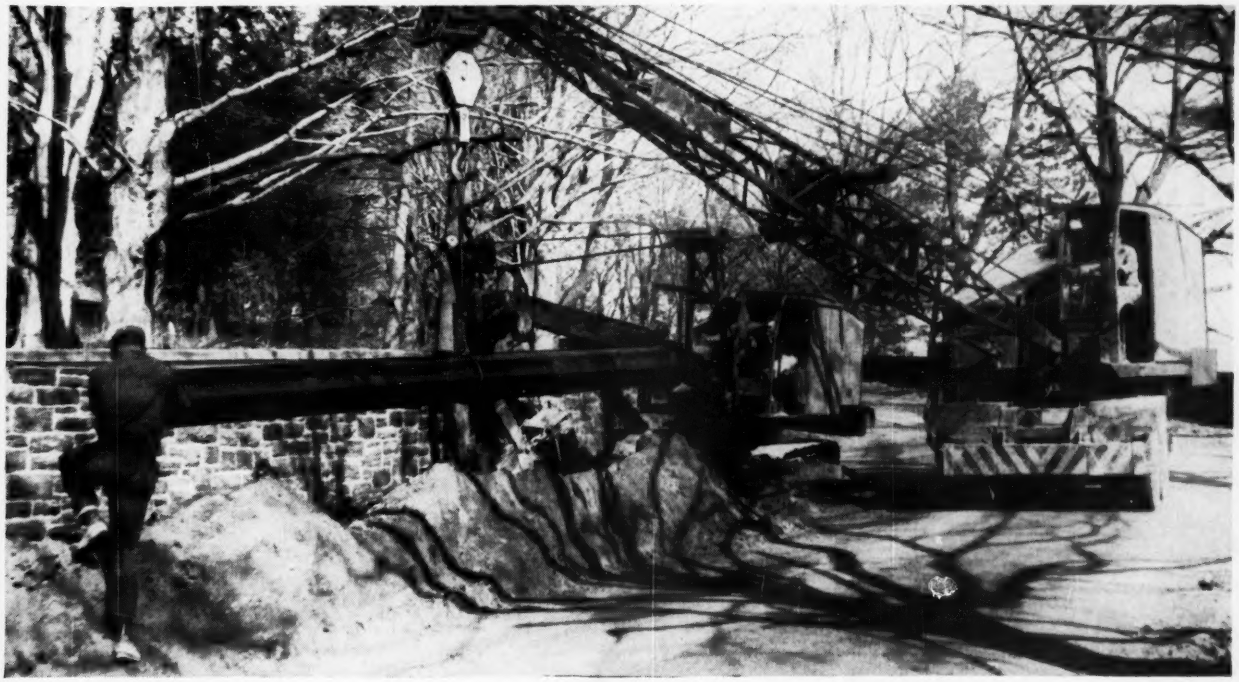

Welded Wire Fabric
2
1/2"
2"

In Indiana (above)—"All-weather" cast iron pipe is quickly installed despite wet trench conditions. Slip-on joints were easily assembled, with one workman using a crowbar.

In Kansas (above)—36" cast iron water main. Another part of this main was floated out of its trench by a heavy downpour. Later a 150 psi water test revealed no leaks in the slip-on joints!

In Pennsylvania (below)—This 16" cast iron pipe is being installed as fast as the trench hoe can prepare the trench.

Handy lengths and slip-on joints make cast iron pipe easy to handle, even in crowded neighborhood sectors; require less labor.



CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Cast Iron Pipe Research Association,
Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

NEWS OF MEMBERS

Chester M. Hinds retired on January 1 as district engineer for the Bethlehem Steel Company in Boston, Mass. Twenty-four years ago to the day, Mr. Hinds joined the Bethlehem Steel Company as Boston district engineer and has been successively sales engineer, chief engineer and, since February 1955, district engineer.

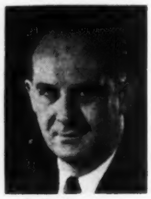
Albro L. Parsons, Jr., Lieutenant Colonel, Army Corps of Engineers, has been assigned to the Corps' Eastern Ocean District as area engineer for Navy and Air Force construction in the Azores. His headquarters will be at Lajes, Azores.

Warren Raeder, professor emeritus of civil engineering at the University of Colorado, has accepted a teaching assignment at the University of Hawaii for one year. Last June Professor Raeder retired from the University of Colorado where he was professor and head of the department of civil engineering for many years.

Donald A. Booth, for the past year assistant engineering manager of the Dravo Corporation, Pittsburgh, Pa., has been promoted to engineering manager. Mr. Booth has been with Dravo for over twenty years.

Walter Dreyer has retired as vice president and chief engineer of the Pacific Gas and Electric Company, San Francisco, after a distinguished 43-year career. He will be retained by PG&E as a consultant on major projects. **John F. Bonner,** since 1955 assistant to Mr. Dreyer, succeeds him as vice president. During the 22 years he has been with PG&E, Mr. Bonner has been closely connected with hydroelectric developments on the major watersheds of Northern and Central California.

W. Dreyer



J. F. Bonner

Harold H. White, former director of blasting practices and explosives research of the Vulcan Materials Company in Birmingham, Ala., has been appointed consulting engineer for the company's research program of explosives effects. When blasting is completed this year on the New York Niagara Power Project, Mr. White will evaluate and analyze an estimated 15,000 seismograph recordings covering the project.

Paul J. Prout, until recently chief draftsman for Kenneth S. Wing-Faia, a Long Beach (Calif.) architectural firm, has been appointed assistant city engineer for Ontario, Calif. During his career he has served as architect coordinator for the Los Angeles County Hall of Records Building and as project coordinator of all working drawings for the design and construction of the 12-story Southern California Edison office building in Long Beach.

(Continued on page 24)

News of Members

(Continued from page 22)

George W. Hutchinson has been chosen from among 44 applicants to supervise the San Mateo Junior College facilities program. Initially, the assignment as director of building construction will involve supervision of the construction of the proposed College Heights campus. For the past year, as field representative for the college facility planning office of the California Department of Education, Mr. Hutchinson has had complete responsibility for capital outlay programs of four state colleges.

S. Mark Davidson, since 1935 a member of the Thompson Pipe & Steel Company, has been made first vice president of the firm. In addition to his new administrative duties, Mr. Davidson will continue in his present capacity of assistant treasurer.

Lawson D. Matter, formerly chief engineer with the water supply section of the Pennsylvania Department of Health, Harrisburg, has joined Albright & Friel, Inc., consulting engineers of Philadelphia as their Harrisburg representative.

George L. Curtis, a vice president of the United Concrete Pipe Corporation at Baldwin Park, Calif., has been elected president of the firm's subsidiary, Rockwin Prestressed Concrete Corporation, Sante Fe Springs. In addition to his new duties Mr. Curtis will continue to function as a vice president for United.

Walter E. Hanson was elected president of the Illinois Engineering Council at the council's annual meeting in Chicago recently. A partner in the consulting engineering firm of Hanson, Collins & Rice, he has served as engineer of bridges for the Illinois Division of Highways and was formerly professor of civil engineering at the University of Illinois.

Frank R. Sherman, who recently became manager of international operations for Daniel, Mann, Johnson, & Mendenhall, Inc. in Los Angeles, has been promoted to the vice presidency. Mr. Sherman's accomplishments include supervision of construction of the Third Air Force Installations in the United Kingdom and the design of the world's largest underwater aqueduct for the government of Venezuela.

Leslie W. Graham has been elected president of the Structural Engineers Association of Northern California for 1960. In 1946 he became a partner with the late William Adrian, past president of the Association, and since Mr. Adrian's death has continued the firm under the name of Graham and Hayes, structural engineers of San Francisco.

Algot F. Johnson, a leader in the construction industry, is a 1960 Beaver award winner. At present, he is chairman of the board of the Al Johnson Construction Company, which he founded in 1927. Mr. Johnson's efforts in behalf of the University of Minnesota and in the promotion of cultural and educational relationships with Sweden earned him the Outstanding Achievement Award for 1955 from the University of Minnesota and rank of Commander of the Royal Order of Vasa presented by the King of Sweden.

D. B. Steinman, New York City consulting engineer, has taken into partnership his associates **R. M. Boynton, C. H. Gronquist** and **J. London.** The firm will operate under the name of Steinman, Boynton, Gronquist and London.

Sidney F. Borg, head of the civil engineering department at Stevens Institute of Technology, Hoboken, N. J., has been appointed a consultant to the New Jersey State Department of Civil Service. Dr. Borg will prepare and grade civil engineering examinations for Civil Service appointments throughout New Jersey.

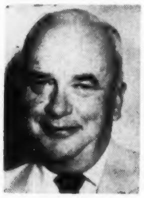
Edward X. Tuttle, a thirty-year veteran in the architectural profession, has been appointed a vice president of Charles Luckman Associates, planning-architecture-engineering firm of Los Angeles, Calif., in their New York office. Mr. Tuttle was formerly vice president and director of development for Giffels & Vallet, Inc., of Detroit.

Glenn W. Holcomb, head of the department of civil engineering at Oregon State College, has been chosen "Oregon Engineer of the Year" by the Professional Engineers of Oregon. Professor Holcomb has taught at Oregon State for over thirty-five years. He served as ASCE Director, 1953-1955, and as Vice President, 1956-1957.

D. F. Peterson, dean of the College of Engineering at Utah State University, is serving this month as senior leader of a seminar on irrigation practices under joint sponsorship of the International Cooperation Administration and the government of Pakistan. From February 15 to February 29 representatives of the countries of the Near East and south Asia will meet in Lahore, Pakistan, to participate in the seminar.

Joseph F. Koenen, during the past four years in charge of all water supply design for De Leuw, Cather & Co., of Chicago, Ill., has opened his own consulting engineering firm at Arlington Heights, a suburb of Chicago. Mr. Koenen's specialties are water supply, sewerage, flood control, and industrial development.

William H. Smith, after thirty-three years of service with the U. S. Bureau of Public Roads, has retired as district engi-



W. H. Smith

F. R. Hall

neer for the Bureau in Nevada. Before joining the Bureau, Mr. Smith was with the California Department of Highways. He did pioneer highway work for the Bureau in Nevada. Succeeding him is **Forest R. Hall,** a veteran of thirty-two years of work with the Bureau in Missouri, Tennessee, California, and on the Alcan Highway.

Alfred Thomas Glassett, prominent engineer and builder, on December 2 received the Silver Stein Award for outstanding leadership to his alma mater, the Massachusetts Institute of Technology. At present, Mr. Glassett is president of the industrial construction firm of W. J. Barney Corporation. As president of the MIT Technology Club of New York from 1933 to 1939, he is credited with keeping the group going during the depression.

Theodore J. Kauer, executive vice president and chief engineer of the Holmes Construction Company, general contractors in Wooster, Ohio, has been named as director of public roads by the Governor of Ohio. From 1949 to 1952 he was Ohio highway director and from 1952 to 1955, chief engineer of the Ohio Turnpike Commission.

M. T. Davisson (right), a civil engineering instructor at the University of Illinois, receives a $1,000 check and citation from Maxwell M. Upson, board chairman of the Raymond Concrete Pile Company, for winning the second annual Alfred A. Raymond Award with his paper on the lateral stability of New York City's new Pier 40.

James A. Vance and **Robert R. Smith,** of Woodstock, Ontario, together with the eight partners, as individuals, of Howard, Needles, Tammen and Bergendoff, of New York City and Kansas City, have formed Vance, Needles, Bergendoff & Smith, Ltd., with offices in Woodstock.

Werner N. Grune, professor of civil engineering at the Georgia Institute of Technology, has been awarded two grants from the National Institute of Health for basic research in two areas of sanitary engineering. One award totalling $23,437 is for research on the determination of low-level radioactivity in water, while the second award of $31,769 is for a study of a gas chromatographic analysis of stack gas pollutants.

Irving Goldfien, an engineer with various Milwaukee City departments for forty-two years, was honored recently by the American Jewish Literary Foundation for his invention of a slide rule used in sewer design and for three mathematical formulas used in engineering. Mr. Goldfien was among those cited in the Foundation's equivalent of "Who's Who."

Warren Parks has been elected president of the Ohio Municipal League for 1960. Mr. Parks has been village manager of the Hamilton County Village of Indian Hill since 1943 and is the only member of the League's board who has served as a trustee since its inception in 1953.

Ralph B. Peck, recent appointee to the Illinois Structural Engineers Examining Committee and professor of foundation engineering at the University of Illinois, is cooperating with Norwegian engineers in measuring earth pressures in the open-cut sections of a new Oslo subway. Professor Peck was in charge of the soil testing program for the Chicago subways when they were built. University of Illinois graduate student **Harrison Kane** in his doctorate analyzes data from two of the Oslo open cuts, while another U. of I. graduate student **Elmo DiBiagio** will do a thesis on his own analysis of the field data he has taken in the latest and most elaborate set of pressure observations at the project.

John A. Grant, Jr., has been promoted to vice president and chief engineer of the Boca Raton (Fla.) firm, the Arvida Realty Company, a subsidiary of the Arvida Corporation. Before joining Arvida Realty last February as chief engineer, Mr. Grant headed his own consulting engineering firm in Miami, Fla.

G. Earl Harbeck, Jr., formerly research engineer of the U. S. Geological Survey's General Hydrology Branch at Denver, Colo., has been appointed Branch Area chief by the Survey. He replaces **Harold V. Peterson,** who has been reassigned as staff scientist to devote full time to research and writing in the field of hydrology of the public domain.

George Loughland has been elected chairman of the Minnesota Water Resources Board, a five-man group which assists in setting up watershed management organizations for local control of water uses under the Minnesota Watershed Act. Mr. Loughland is a retired executive officer of the Northern States Power Company.

B. B. Talley, Brig. Gen., U. S. Army (retired), resigned as vice president of Raymond International, Inc., New York City, on December 31 to open a private consulting engineering practice. General Talley will reside in Mangum, Okla., where in addition to his engineering practice he will operate his cattle and farming business.

Richard C. Kasser, a nationally recognized expert in aluminum design and engineering, on December 11 was named manager of design and sales engineer for the Aluminum Company of America's newly created Aluminum Structural Division in Pittsburgh, Pa. Mr. Kasser joined Alcoa in 1941 as a construction engineer at the company's Alcoa (Tenn.) works, becoming head of the structural section of that division in 1949.

(Continued on page 126)

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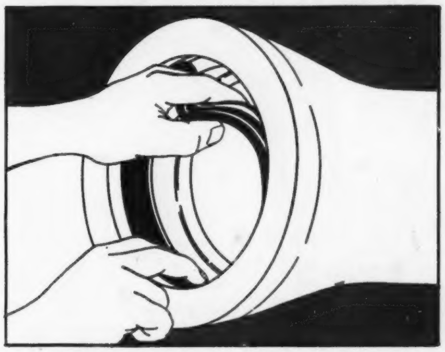
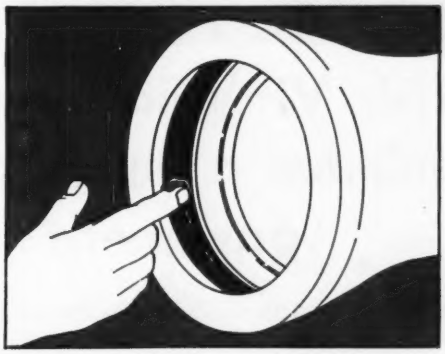
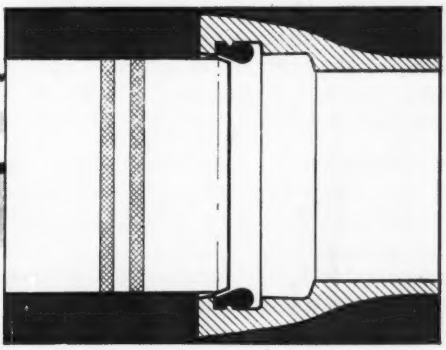


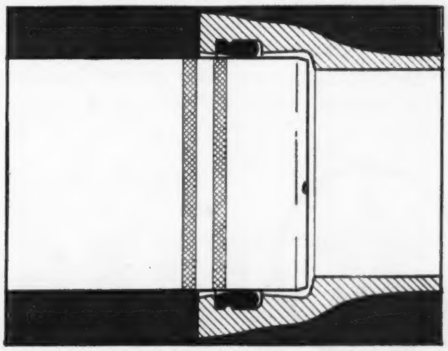
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket

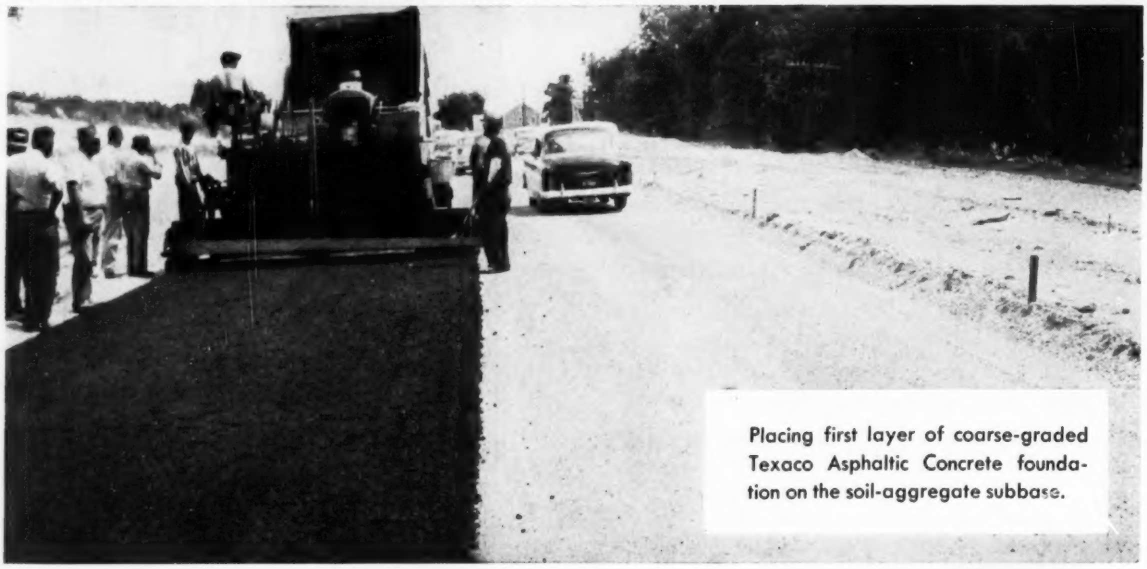


Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket . . . the job's done!

Contractor: ADAMS CONSTRUCTION COMPANY, Roanoke, Va.



Placing first layer of coarse-graded Texaco Asphaltic Concrete foundation on the soil-aggregate subbase.

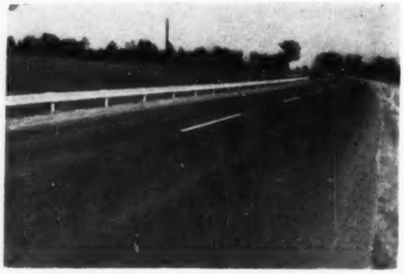
This Virginia highway needed a heavy-duty pavement

A 4½-mile section of U. S. Route 460 in Prince Edward County is an example of heavy-duty Texaco Asphalt paving as Virginia constructs it. Both the foundation and the wearing surface are of rugged plant-mix Asphalt construction. Coarse-graded Texaco Asphaltic Concrete was used for the 5½-inch foundation and fine-graded Texaco Asphaltic Concrete for the 1½-inch wearing surface. Under this asphalt pavement is a 5-inch soil-aggregate subbase.

Its performance on Virginia's primary highways recommends this heavy-duty type of Texaco asphalt construction for the Interstate Highway System. Not only does it absorb punishing impact year after year, with a minimum of upkeep, but its first cost is substantially lower than that of rigid paving of comparable design. Let Asphalt help give your State extra miles of modern roads for its highway dollars.

Helpful information on heavy-duty Asphalt paving, as well as the various intermediate and low-cost types of Asphalt construction, is supplied in two free Texaco brochures. Ask our nearest office to send you copies. There is no obligation.

Constructing fine-aggregate Texaco Asphaltic Concrete wearing surface.



Durable, resilient, glare-free Texaco Asphaltic Concrete on 4½-mile section of U. S., Route 460 in Prince Edward County, Va.

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TEXACO REG. T. M.

TEXACO ASPHALT

..... Am-Soc Briefs

▶ ▶ Water problems will be featured at the New Orleans Convention. . . . Civil engineering problems about water, its control and drainage, will dominate the New Orleans Convention program, with the Hydraulics and the Waterways and Harbors Divisions sponsoring a number of papers in this increasingly vital field. This issue carries the complete program (pages 75-81), plus a page of photos of the picturesque host city--they should be strong inducement to attend.

▶ ▶ The best water source is pollution abatement. . . . This was one of the major conclusions of the Sanitary Engineering Division's Conference on Pollution Abatement held in Cincinnati this January. The findings of this important conference are reported on pages 50 and 51.

▶ ▶ Are you planning to transfer to a higher grade? If so, now is the time! Members who were in the Junior Member and Associate Member grades on June 6, 1959, may apply for transfer to a higher grade under the rules that were in effect before the constitution was amended. However, applications intended for processing under the old rules must be received before June 6, 1960.

▶ ▶ Group life insurance has now been made available to members. The plan, which is especially advantageous to younger members, is described on page 60. Full details and enrollment forms have been mailed to all members.

▶ ▶ For sale. . . . In response to demand, the twenty-five papers presented at the Conference on Electronic Computation, held in Kansas City in November 1958, are being offered in a single, paper-bound volume. The price is $10 (post-paid); orders should be sent to Society Headquarters. . . .

▶ ▶ Hot off the press, also, is a new ASCE Manual of Engineering Practice--the joint work of the Society's Sanitary Engineering Division and the Water Pollution Control Federation--entitled "Design and Construction of Sanitary and Storm Sewers." This one is $3.50 to members (half the list price), and there is a coupon to make ordering easy (page 149).

▶ ▶ For free. . . . A pamphlet on the research problems facing the profession--a record of the addresses and reports presented at the Second Conference on Research in Civil Engineering--is available on request. The second conference was held at Northwestern University last September. Sponsors were the ASCE Committee on Research and the Technological Institute at Northwestern.

Independent Tests Show:

Flow characteristics of AMVIT clay pipe permit efficient, lowest cost-in-place sewer design

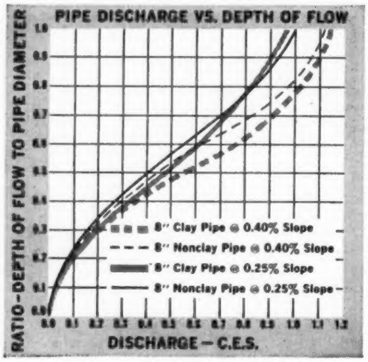
There is no difference in value of Kutter's "n" between different types of pipe materials

There have been many claims and counter-claims dealing with the "n" factor in the Manning approximation of the Kutter formula relating to the flow-coefficient of friction of various types of piping materials.

For many years, sewer designers have used the "n" factor of .013 in the design of sanitary sewer systems involving vitrified clay pipe. Recently, the manufacturers of substitute non-clay materials have claimed that the "n" factor for their product is less than .013, usually claiming it is .010.

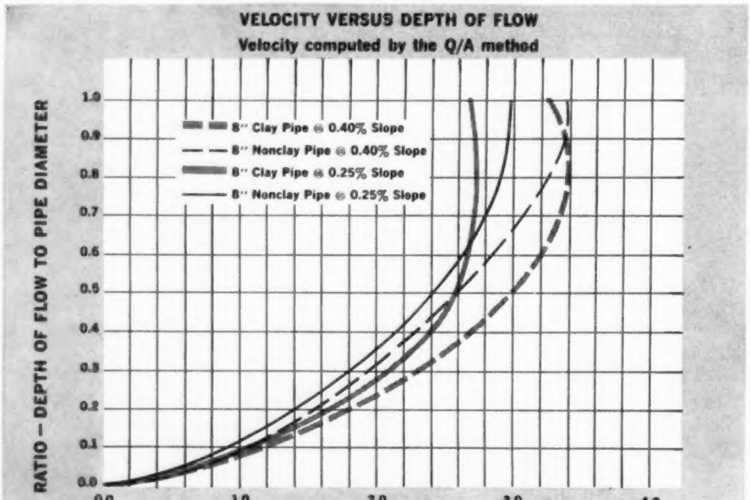
This supposed difference in "n" factor has been used in the promotion of these substitute materials on the basis that, since their product has a supposedly lower "n" factor, designers must use a different design criteria for clay pipe. *This is only sales promotion talk.*

Studies at the University of Iowa and at Ohio State University have proven that there is essentially *NO* difference in the value of Kutter's "n" between different types of pipe materials regardless of pipe lengths, type of joints or any other consideration.



This graph shows discharge versus depth of flow.

In normal service a slime coating will be built up on the interior surface of the pipe. Therefore, the friction factor depends upon the relative smoothness of the slime surface and not upon the pipe material itself. Clay pipe is the only pipe material that will resist the corrosive action of the acid laden slime.



This graph shows velocity as related to depth of flow.

Don't be misled by exaggerated claims. For more information on this vital subject, or for complete data on how we can help you cut sewer project costs, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.

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do you know that

The U.S. produced more steel last year than in 1958? Despite the long steel strike, our 1959 output of steel was 93,436,813 tons—the seventh highest in the history of the industry and over 8 million tons above the 1958 output of 85,254,885 tons. December production totaled 11,980,000 tons, an all-time monthly record. On the basis of the industry's rated annual capacity of 147,633,670 tons (as of January 1, 1959), the nation's steelmaking facilities were utilized at only 63.3 percent of capacity last year. Figures are those of the American Iron and Steel Institute.

▪ ▪ ▪

Business failures of U.S. construction contractors are on the increase? A record of failures and analysis of causes in the 1934-1958 period has been prepared by the Business Economics Department of Dun & Bradstreet. In 1934, the heart of the depression, 826 firms with liabilities of $26,341,000 ceased operation; in 1958, 2,162 firms with liabilities of $115,115,000 went out of business. There were fewest failures—92 firms with liabilities of $3,559,000—in the booming war year of 1945. Major reasons given for failure were lack of well-rounded experience (22.8 percent) and incompetence (40.8 percent).

▪ ▪ ▪

The U.S. Coast and Geodetic Survey is on a 200-year job? In 1878 the Survey began a shore-to-shore and border-to-border program to determine elevations and geographic positions that must be established before accurate maps and charts can be made. The Survey hopes to have the project—said to be one of the government's oldest and least known operations—completed by 2060, though findings of the Space Age may force revisions and resurveys that could postpone the date. Except for a few electronic devices, the Survey's tools are still the theodolite transit, the level, and the rod and chain.

▪ ▪ ▪

The nation's railroads are scrapping freight cars at double the rate of putting new ones into service? In the twelve-month period ending with October, the industry retired 82,849 cars and installed 39,870, according to the Car Service Division of the Association of American Railroads. In the meantime, 40,097 new cars are on order for future delivery.

▪ ▪ ▪

A machine that manufactures earthquakes has been built by Caltech? By cracking a few real buildings under controlled conditions the Earthquake Engineering Research Institute—a nationwide agency centered at California Institute of Technology—hopes to learn how to build structures that can survive earthquakes without serious damage. The machine weighs 500 pounds, but is small compared with the earthquake it can simulate. Shaking is produced by a pair of 20-in. swing boxes that counter-rotate unbalanced amounts of lead weights. Power is provided by a 1½-hp motor.

▪ ▪ ▪

Automobile exhausts are pouring millions of tons of poison into the atmosphere? A recent *Harpers Magazine* article, entitled "How Much Poison Are You Breathing," says that in 1958 these exhaust products included over 169 billion pounds of deadly carbon monoxide; over 21 billion pounds of "cancer-causing hydrocarbons"; and almost 4 billion pounds of smog-producing oxides of nitrogen. On the more hopeful side, the Franklin Institute Laboratories report successful use of chromite catalysts to reduce the amount of nitric oxide in the exhaust.

▪ ▪ ▪

Catwalk cables have been strung between anchorages on the Throgs Neck Bridge? Spinning of the main bridge cables will start in February. Completion of the $80 million span connecting the Long Island Expressway with the Bronx and the New England Thruway is scheduled for early 1961. The structure will relieve traffic jams on the parallel Whitestone Bridge.

▪ ▪ ▪

Face-lifted older buildings outnumber newer structures in New York's changing skyline? Despite the new buildings erected in Manhattan since the end of the war, major facade changes on the city's older office and commercial buildings outnumber new construction by more than ten to one. In the past decade 97 office buildings were erected in Manhattan, while 1,100 applications for alterations to existing structures were filed with the Department of Buildings. Statistics are from the Brisk Waterproofing Company.

▪ ▪ ▪

This year will see the start of the biggest building boom in history? The prediction that in 1960 the U.S. will embark on the greatest building boom the world has ever seen was made by Architect Charles Luckman at the 39th annual dinner of the Massachusetts Building Congress. He forecast construction outlays of $650 billion in the sixties—the result "of the population explosion, the surge of economic expansion, and the accelerating rate of change in building needs." The March issue of Civil Engineering will feature new building projects—from Seattle to Jacksonville.

What ASCE has done to improve employment conditions . . . .

R. K. LOCKWOOD, F. ASCE, Civil Engineer, Sika Chemical Corporation, Passaic, N.J.

In speaking of what ASCE has done to improve employment conditions, it is probably first necessary to define what we mean by employment conditions. Frequently the term is taken only to mean salaries and what have come to be known as fringe benefits. These are certainly most significant elements in satisfactory employment conditions. However, students of personnel management and psychology have dug deeper into the subject and found that other elements are highly significant. One of the most important is professional recognition. Engineers in general are extremely sensitive to their position as members of a recognized profession. Actually two kinds of recognition are involved—that by fellow employees and fellow professionals, and that by the community. Also, engineers in their own minds identify themselves with management. When kept very long in positions where they do not participate in management planning, they generally become dissatisfied.

It has been found that where any one of these elements is slighted, the employee becomes dissatisfied. This dissatisfaction frequently manifests itself as disapproval of the salary structure. Large organizations have studied cases where salary levels were higher than average and found a large measure of dissatisfaction among employees—where professional recognition or participation in management decisions was lacking.

These elements of employment conditions have been described variously by different people. However, in any study made by amateurs or professionals, it will be found that the basic elements of money, professional stature and management identification are invariably present. Let us take these one at a time and see what the ASCE has done with regard to them.

Salaries

As early as 1912 the Society had a committee charged with the responsibility of determining proper compensation, duration of employment and prices charged for different classes of private work. Although I have not made a complete study of the activities of all the engineering societies in existence at that time, I believe this is the first such activity by any professional engineering society. It was a highly important precedent, set forty-seven years ago. Since that time, the Society has been continually concerned with the study and evaluation of salary levels.

The next milepost in the effort to protect salaries came in the 1930's, that period when the foundation of the American economy began to crack badly. The problem of maintaining adequate levels of engineering salaries was attacked on several fronts. Extensive public relations programs in Washington and a number of state capitals were established to spotlight the significance of the engineer's position, and extensive efforts were made among legislators to stimulate the construction of delayed public works. In this way, many jobs were created for engineers. During this period, weekly reports were submitted to the President of the United States by ASCE concerning public works. Certainly the Society played a significant role in the development of the Public Works Administration.

The Society currently conducts a biennial salary survey which has been used effectively by engineering agencies in an effort to achieve salary levels commensurate with the work they are doing. Approximately 4,000 copies of these salary reports are distributed each time a survey is made. Numerous commendatory letters are received at Society headquarters. Many of them are from department heads who report successful use of the salary data in setting equitable compensation levels for their employees. Along with this, the Society publicizes a salary index by region for both public and private work. This also has proved extremely helpful in establishing improved levels of compensation, particularly in governmental agencies below the federal level.

I certainly recognize that the phenomenal growth of engineering salaries in the past 8 years, which amounts to 65 percent for new graduates on first jobs, has been the result of many factors. Certainly, however, the continual spotlight on the salary structure provided by the ASCE Committee on Salaries (now a part of the Committee on Employment Conditions) has contributed significantly to the upward momentum.

Another factor affecting salary structure should be mentioned—the fees received for engineering work. Salaries come out of the fees for a given job. If these are low, salaries will be low. The Society's Committee on Professional Practice has labored long to

develop a manual on "The Private Practice of Civil Engineering." The manual includes suggested fee curves as a basis for negotiations, which have been most helpful to clients and engineers.

In the field of recognition, one of the most significant steps was the development of a model law in 1911 for the licensing of civil engineers. As early as 1899, the desirability of developing judicious legal restrictions against the unauthorized and improper use of the title "Civil Engineer" was discussed by ASCE. The Society took a leading role in the development of the first model law for registration and has ever since maintained its leading position in the development of such legislation.

In 1922, a Committee on Public Relations was formed. As previously mentioned, in the 1930's extensive federal and state public relations programs were developed to establish civil engineering as one of the recognized professions.

It should be realized that professional recognition does not spring upon the public consciousness in one explosive moment of enlightenment, but rather it is an awareness that must be nurtured and fed continually. The early recognition by the Society of the necessity for continually hammering away at the establishment of the professional position of engineers has contributed in great part to the public esteem in which the profession is now held.

Today, the Society engages in an extensive program aimed at furthering professional recognition. An active public relations department within the national headquarters is constantly developing programs informing the public of the contributions of the civil engineer to community life. At Society conventions, press releases are sent to the home-town newspapers reporting on the professional accomplishments of members of the Society. Likewise, reports of professional accomplishments are fed in a continuing stream to the professional journals and magazines throughout the country. Projects such as the "Seven Wonders," described in an article in *Readers' Digest*, spur public understanding of the magnitude of civil engineering accomplishments.

But the problem of professional recognition does not stop with educating the public. It involves also activities within the profession to raise the level of professional standards. Certainly the work of the Engineers' Council for Professional Development has contributed tremendously to the acceptance of engineers as members of a recognized profession. Many other factors affect the status of engineers and the general acceptance of engineering as a profession. No one act or program could ever have established the engineer in his present position. The recognition now enjoyed is the cumulative effect of many years of effort.

Recognition, it must be remembered, is first and foremost an individual responsibility. Engineers must be worthy of their profession. Each, by his profession and public life, by his ethics and actions, ought to be an example of a man qualified to be called a professional and an engineer. The Society's activities cannot and should not glorify and promote the profession beyond what the individuals deserve.

Identification with management

In studies of employment conditions which ask such questions as "What do you like most about your job" or "dislike about your job," the answer most frequently given is "opportunities for advancement" or lack of them. The answer may be phrased many ways. Inevitably, however, the engineer wants to be "in on" the decisions affecting the projects on which he is working. Engineers almost invariably expect eventually to become part of the management team. Stated in another way, engineers dislike identification with labor groups. This can be seen very clearly in the very low percentage (2.3 percent) of ASCE members who belong to bargaining groups as reported in the recent ASCE study of employment conditions.

The engineer did not always have the right to choose his own association as a member of the management team. In the early days of the Wagner Act, engineers, because of their relatively small numbers, were forced into heterogeneous bargaining groups along with other odds and ends of the industrial labor force. The engineer did not have the right to stay out of such groups nor did he have the privilege of organizing his own professional bargaining group.

To remedy this situation, the Society formed a Committee on Unionization (which later became the Committee on Employment Conditions) to recommend to the Board of Direction suitable courses of helpful action. During 1943-1944, a plan was developed in which a Local Section of ASCE could take the initial step toward forming a collective bargaining group composed solely of professionals. In 1942, Howard Peckworth, recently a Director of the Society, but then a member of the headquarters' staff, was assigned to full-time duty as aide to the Committee on Employment Conditions and he traveled extensively in furthering its work.

Current ASCE activities concerning the welfare of publicly employed engineers is now the responsibility of the Committee on Engineers in Public Practice.

It has been possible here to touch only on the highlights of the involved and continuing program in which the Society has been engaged for about fifty years. Improvement of working conditions requires continuing effort, much of which by its very nature is unspectacular. The development of exemplary employment conditions involves many, many factors including such things as the public stature of the engineer, the place of technology in our modern society, the amount of money available for civil engineering work, both public and private. Change must be evolutionary rather than revolutionary.

In closing this review of what the ASCE has done to improve the employment conditions of engineers, I would like to take a quick look at what lies ahead. While we have made good progress in the past as a profession, we cannot afford to stand still. Efforts along the lines discussed above should continue. There is, however, one significant weakness. While the planning and programming is effectively organized at a national level, the program is somewhat less well organized at the local level and it is here that the most effective action can be taken. It is most helpful to the national committees to be backed up by strong local or regional groups. This facilitates the flow of basic information to the planning groups so that programs can be based realistically on actual conditions. There are still areas where salaries have not kept pace with a spiraling economy. Furthermore, action at the local level is always more effectively handled by local people—with adequate support at the national level. A significant step forward would be the development of strong functioning committees on employment conditions in each of the Local Sections.

Employment conditions are closely related to the professional position of engineering itself. No one program and no single effort will contribute to the improvement of these conditions. There is still much to be done.

(This article was originally presented by Mr. Lockwood at the Washington, D. C., Annual Convention of ASCE before the session of the Conditions of Practice Department sponsored by the Committee on Employment Conditions and presided over by its chairman, Waldo G. Bowman.)

Experimental installations to increase digester capacity

HUGH A. SCHREIBER, Superintendent, Sewage Treatment Plant, Washington, D. C.

When the Washington, D.C., Sewage Treatment Plant was faced with the need for expanded facilities to meet an expected 70-percent increase in the quantity of sewage over that for which the plant was designed, it was incumbent on the District of Columbia to approach future plant expansion on the basis of making more efficient use of existing facilities. The installation of secondary treatment and additional elutriation facilities was also indicated.

A Board of Engineers was chosen consisting of Frank A. Marston, F. ASCE, of Metcalf & Eddy, Gustav J. Requardt, Hon. M. ASCE, of Whitman, Requart & Associates, and Samuel A. Greeley, Hon. M. ASCE, of Greeley & Hansen. The District of Columbia contracted with these consultants as a group to study the sewage treatment facilities and to make recommendations for future plant expansion. The Board of Engineers decided to conduct its own research project on various methods in use to increase digester loadings. Subsequent to this study, the Board was engaged by the District to furnish plans and specifications in line with the results of the study.

To make more efficient use of the existing plant, it was necessary to install external sludge heaters and thickening tanks, and to convert the conventional digesters for high-rate (or more efficient) operation. The original design, made in 1936, was for a tributary population of 975,000 and a sewage flow of 175 mgd. By 1980, municipal growth and increased tributary population will require the treatment of 290 mgd from an estimated population of 1,791,000.

The present plant contains the original twelve digesters, each with a capacity of 142,000 cu ft. These digesters have fixed covers and are heated by circulating hot water through circumferential coils mounted on the inside walls.

Engineers institute study

The study by the Board of Engineers concluded that there were four principal methods for increasing digester loading. Each method differs sufficiently from the others to raise the question as to which is the most efficient for the type and quality of the sludge to be handled. Here was an opportunity to equip four of the digesters with four different types of facilities to accomplish increased loading. This would be done with the idea that whichever method proved most successful would be applied in the remaining eight digesters as increased capacity is required.

The objective is to accelerate the biological process by providing a more intimate mixing of raw and digesting sludge, and to prevent the accumulation of a heavy scum layer on top of the digesting sludge, thus making use of the full capacity of each digester.

1. Gas-lift installation

One unit, identified as "the gas-lift type" consists of a compressor and a digester mixer. The compressor has a capacity of 270 cfm at 6 psig, and takes its suction from the gas dome. The gas is then discharged under pressure into the gas mixer. The mixer consists of a cluster of four eductor tubes, 24 in. in diameter, approximately 26 ft long on top, on which is mounted a common head-recovery box, 5½ ft in diameter, serving all four tubes. Inside each eductor tube is a 2½-in. stainless-steel gas line extending 11 ft below the water surface, on the end of which is mounted a gas diffuser. The diffuser acts as a gas lift —hence the name "gas-lifter."

The gas being released under pressure rises in the eductor tubes, pulling the liquid with it up through the tubes to overflow the top of the recovery box. This imparts motion to the digester liquid and provides the desired mixing of the entire digester contents. The complete mixer has a capacity of 27,000 gpm.

To permit removal of the gas diffuser without taking the digester out of service, the diffuser pipe is set inside a 6-in. steel pipe, which extends 2¼ in. below the surface of the liquid, thus providing a water seal. Thus no gas escapes when the diffuser is removed.

2. Continuous gas diffusion

A second method, identified as "continuous gas diffusion," utilizes essentially a compressor and a gas diffuser unit. As in the first method, the compressor takes its suction from the gas dome on top of the digester and discharges the gas through a diffuser

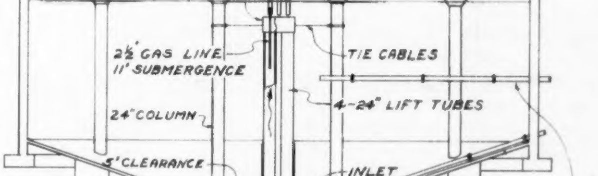


FIG. 1. The "gas-lift system" consists of a compressor with a capacity of 270 cfm at 6 psig and a digester mixer (a cluster of four eductor tubes).

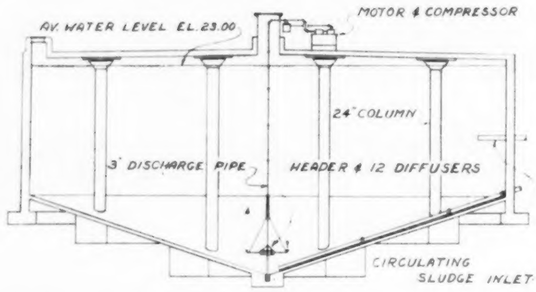


FIG. 2. A second unit being studied at the Washington, D. C., Sewage Treatment Plant is the "continuous gas diffusion" system. This consists of a compressor rated at 50 cfm at 15 psig and a gas diffuser unit.

unit. The compressor has a capacity of 50 cfm at 15 psig. The diffuser unit consists of a gas discharge pipe through the dome, extending to within a few feet of the bottom of the digester. To the end of this pipe is attached a gas diffusion header and 12 diffusers. The diffusion header consists of a 3-in. length of 30-in.-diameter pipe, into which tubes and diffuser units are connected. This entire assembly is supported vertically from the bottom of the tank and given lateral support at the top and bottom.

The release of gas through the diffusers functions as a gas lift, which imparts motion to the digester contents. This motion is a gradual roll, moving vertically upward at the center, radially outward at the top, and back across the bottom of the tank from the periphery toward the center. Thus the heavier digested solids are continually drawn towards the sump for removal.

To permit removal of the diffuser equipment without emptying the digester, the diffuser units are connected to the header by a knee-action joint. When the unit is in operation, the diffusers are held in a horizontal position by cables clamped to a set collar on the gas-feed line. For removal, the set collar slides down the feed line and the diffusers drop to a vertical position, so that the entire unit can be withdrawn through the gas dome.

3. Mechanical mixing system

A third unit, identified as a "mechanical mixing system," has four independent mixers, each consisting of an electrically-driven propeller and a draft tube capable of circulating 7,500 gpm of water. The four units are spaced 90 deg apart on a radius about two-thirds that of the tank. The propeller and drive mechanisms are supported from the roof of the digester and are completely independent of the tube, so that all the rotating mechanical equipment can be removed and replaced without entering or dewatering the digester. The draft tube is supported vertically from the bottom of the digester and is given lateral support near the top by guy wires to the columns.

This installation has several distinctive features. The motion is imparted to the digester contents by mechanical means. The drive motors are reversible. The liquid level in the digester must be controlled within close limits—5 in. All sludge must be added to the digester through one of the four draft tubes. The normal direction of flow in the tubes is from top to bottom. The discharge ends of the draft tubes are positioned to impart a circular motion to the digester contents, creating maximum turbulence at the bottom. With this system, as with the previous one, the digester must be taken out of service for maintenance and repair of the propeller and drive, although it need not be dewatered.

4. Gas recirculating system

The fourth unit, called a "gas recirculating system," consists of a gas compressor and eight vertical discharge pipes equally spaced circumferentially on a radius approximately two-thirds that of the digester. The compressor has a capacity of 200 cfm at 15 psig and takes its suction from the gas dome. The discharge pipes are 2 in. in diameter and extend about 15 ft below the surface of the liquid. The compressor discharges through one pipe at a time—a procedure made possible by having the eight discharge pipes manifolded through automatically-controlled valves, with a program timer to control the discharge period through each pipe in sequence. In other words, the rotation is set up on a program basis.

The discharge pipes enter the roof through pipe wells that extend below the surface of the liquid, thus providing a positive gas seal. This permits adjustment, removal and replacement of the discharge pipes without taking the tank out of service or otherwise interrupting its operation. The wells also serve as the sole support for the pipe, thus reducing to a minimum obstructions that will collect rags and trash.

FIG. 3. The "mechanical mixing system" has four independent mixers, each consisting of an electrically-driven propeller and a draft tube capable of circulating 7,500 gpm of water.

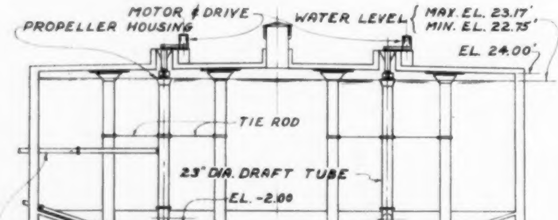
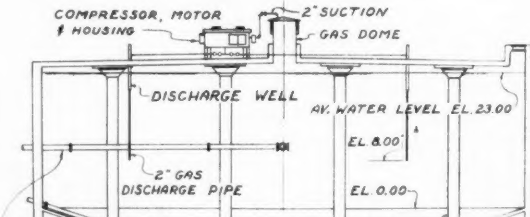


FIG. 4. The fourth unit under study is the "gas recirculating system," which employs a gas compressor with a capacity of 200 cfm at 15 psig and eight vertical discharge pipes.



Distinguishing features of this installation are the absence of supporting equipment in the digester, thus permitting maintenance of all mechanical equipment without taking the tank out of service. Also, the discharge points are distributed to provide uniform mixing of the upper part of the digester contents, and at the same time to permit sealing and concentration of the heavier digested materials at the bottom.

Additional facilities

Each of the four test digesters is equipped with identical external equipment, consisting of: (1) a variable-speed pump to control the rate at which solids are added, (2) metering equipment to give a continuous record of the quantity of solids being added, and (3) sample connections to permit periodic withdrawal of material from the digester for analysis.

The variable-speed pumps are continually withdrawing sludge from the bottom of each digester and pumping it through heat exchangers where the raw sludge is added. The mixture of raw and digesting sludge is then returned to the digester through the circulating sludge inlet.

The relation between the capacity of the circulating pumps and the volume of the digester is such as to completely replace the digester contents in 60 to 120 hours, or in 2.5 to 5 days. The entire sludge handling system and the high-rate digestion process is designed to handle 8 lb of suspended solids per cubic foot of digester capacity per month. This is equivalent to 0.2 lb of volatile solids per cubic foot of digester capacity per day.

It is expected that, with these facilities and with periodic analyses, it will be possible to evaluate the capabilities of the four methods of mixing.

The time and effort involved in such an undertaking should not be minimized. On the assumption that normal digestion under the environment to be established here requires about 17 days and the condition that a uniform quality of sludge is being continually circulated through each digester, maximum stable conditions may not be achieved for a long time.

We trust that those interested in these processes will be patient and will not expect conclusive results the first few months.

(This article was originally presented by Mr. Schreiber as a paper at the ASCE Annual Washington, D. C., Convention, at the Sanitary Engineering Division session on High-Rate Sewage Sludge Digestion, presided over by Stanley E. Kappe, Chairman of the Division's National Capital Section.)

Consultants and Government Work

A "policy statement" on the best use and relationship of private consulting services and permanent engineering bureaus in Federal agencies—prepared by the Executive Secretary at the request of the Board of Direction—was published in the January issue (page 68). Two Appendixes, which further clarify the Society's stand in this important matter, have been prepared and are given here.

Appendix I: *Definition of "Minimum Constant Load"*

The term "minimum constant load," as used in connection with the operation of engineering bureaus in governmental agencies, may merit further definition. Although this decision will require specific determination by the administrator of each engineering bureau, there are certain principles to be observed.

The report of the Second Hoover Commission recommends (No. 19):

> "That the Federal design and construction organizations (*a*) retain in their own organizations only the personnel required for preliminary study, preplanning and budgeting, and essential supervisory management and control, and (*b*) contract to private architect-engineering and construction firms design and supervision of construction to the maximum extent consistent with national security."

Certainly the functions of (*a*) preliminary study, (*b*) preplanning and budgeting, and (*c*) essential supervisory management and control, are basic elements in the "minimum constant load." To this might be added special research functions (as at Vicksburg by the Corps of Engineers) that are long-range in character; also the development of criteria for design and for specifications.

The degree to which design and construction functions should be undertaken by government bureaus would properly be determined on the basis of cost. The cost of engineering is always a relatively small part of the total cost of the project, and ingenuity of design is frequently a major factor in the cost and serviceability of the project. The total result cannot be measured by comparing engineering costs only. Design and construction should generally be performed by the bureau only when it would be clearly less costly than equivalent work by private practitioners.

Few public engineering offices maintain the detailed cost records that are required for accurate appraisal and comparison of their costs with the prevailing charges for engineering services. Even so, considerable data are available to indicate that costs are often less in private firms than in governmental bureaus, particularly when indirect costs are properly recognized. Only with adequate detailed cost records available can the "minimum constant load" be established within practical limits.

Appendix II: *Advantages to the Public in the Use of Private Engineering Services by Governmental Agencies*

Judicious and proper use of private engineering services by governmental agencies provides:

1. *Economies* in the handling of engineering in federal programs, particularly for increased work loads occasioned by programs of an emergency nature, and projects of unusual character or magnitude.
2. *Greater alertness* to effective prosecution of the work in compliance with time schedules.
3. *Opportunities for selecting specialists* whose unusual skills, knowledge and experience would not otherwise be available to public agencies.
4. *Unimpeachable records of engineering costs* allocable to specific projects in an improved accounting system that would serve the interests of sound administrative procedures.
5. *A deterrent to over-expansion* of governmental departments, thus minimizing "empire building."
6. *Affirmation of the principles of free enterprise* which are implicit in the concepts of sound economy under a democratic form of government.
7. *Greater national security* through build-up and strengthening of a pool of highly qualified specialists whose services are available in times of emergency.

Concrete frame supports 5½-mile conveyor belt

J. ROY FRASER, M. ASCE, Division Engineer, Link Belt Company, Atlanta, Ga.

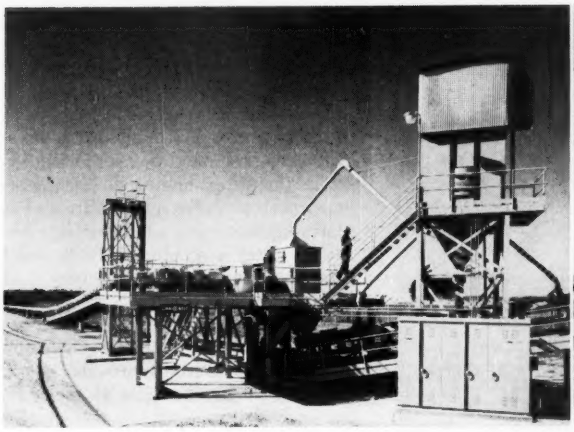
The longest permanent belt-conveyor system in existence, including the longest single conveyor unit, is supported by prestressed concrete stringers resting on precast reinforced-concrete U-shaped stands. Extending for $5\frac{1}{2}$ miles across country, the seven-unit system transports raw materials from the quarry of the Ideal Cement Company in Lawrence, Okla., to its new multimillion-dollar plant at Ada, Okla.

With the decision to build a new plant at Ada—more than doubling the capacity at this location—careful studies were made of various methods of transporting the raw materials from the quarry to the plant. These studies indicated that the belt conveyor, as ultimately installed, would provide the most economical and efficient means of transportation. Ideal is one of the largest producers of portland cement in the United States, and its plant at Ada is one of 17 covering an area from the Gulf Coast to the Pacific Northwest.

Final section of conveyor belt crosses railroad on 97-ft post-tensioned girders of lightweight concrete. Unusual drive-terminal tower described in text is at left end of this section. Cement mill, storage facilities and mill conveyor system are in background.

In its course across country, the transport conveyor system changes direction several times and crosses two secondary highways, a branch-line railroad and a main-line railroad. The grade of the conveyor roadbed generally follows the terrain; low places were filled and high places crowned to give a smooth rolling grade conforming to major contours. Grades average about 6 percent, with the steepest about 14 percent.

This conveyor system, consisting of seven endless rubber belts 36 in. wide, operating at about 500 ft per min, is designed to handle 1,000 tons per hour of either $\frac{3}{4}$-in. crushed limestone or minus 6-in. shale. Each of the seven units, or flights, that make up the 11 miles of $\frac{1}{2}$-in.-thick rubber conveyor belting used for the project was vulcanized in one piece, thus eliminating fasteners and providing uniform endless belts. Details of the seven flights are given in Table I. One of the problems requiring the most ingenuity on the project was the arrangement of the sheaves, pulleys and sliding carriages required to accommodate the belt elonga-



Typical drive terminal (above left) includes counterweight tower, drive machinery, and dust arresters. The steel terminal structure rests on a mat foundation and is not tied to the concrete approach structures at left because of framework deflections under starting loads. Highway crossing (above) is supported on T-shaped piers. The conveyor is mounted on the top of the prestressed girders, which have their top flanges widened to serve as walkways.

tion that occurs under various conditions of loading and starting. On the 2¼-mile length of the longest flight, this elongation totals 90 ft, all of which is taken care of in the drive terminal and the take-up towers. This section is the longest single belt conveyor ever built.

The entire length of belt conveyor is supported on prestressed concrete structures made with lightweight aggregate. This is a radical departure from the usual conveyor construction of steel channel stringers with corrugated metal covers, or covered steel-truss galleries.

Structural system

The basic structural system of the conveyor consists of a series of precast, prestressed concrete channel stringers each spanning 50 ft and supporting the conveyor, which is suspended below it on brackets. The stringers also form a cover over the top of the belt. One side of the conveyor is curtained by a continuous, corrugated aluminum wind guard, which is bolted to the brackets supporting the conveyor itself. The belt is thus covered on top and on one side, a necessary feature to keep it from being blown off the idlers and to prevent material from being blown off the belt. See Fig. 1.

The prestressed concrete stringers rest on precast reinforced concrete U-stands, which are attached to field-poured reinforced concrete footings embedded in the ground. Where the conveyor is raised to clear highways and railroads, the U-stands are mounted on the top flanges of pairs of prestressed concrete girders or on elevated piers; where a span exceeds 50 ft, the conveyor is mounted on the prestressed girders with top flanges made sufficiently wide to serve as walkways. The girders supporting the conveyor follow as closely as practicable the theoretical vertical curves of the belt. The girders are supported on poured-in-place bridge-type piers of reinforced concrete which vary in height, and which utilize round concrete columns supported on reinforced concrete spread footings.

The last belt conveyor in the system is elevated throughout its entire length to cross the main line and passing tracks of the Frisco Railroad. For this crossing the conveyor stringers are carried on a series of 97-ft prestressed

TABLE I. Details of the seven conveyor flights

Flight No.	Approx. Flight Length, ft	Rise(+) Fall(−) ft	Effective Belt Tension, lb	Belt hp	Max. Belt Tension, lb
1	1,620	+ 65	8,640	118	11,690
2	4,370	− 22	9,500	130	12,800
3	11,920	−155	15,025	206	20,500
4	4,770	+ 81	16,890	230	23,000
5	2,810	− 34	3,880	53	5,300
6	2,950	+ 13	7,745	106	10,500
7	560	+ 22	3,060	48	6,010

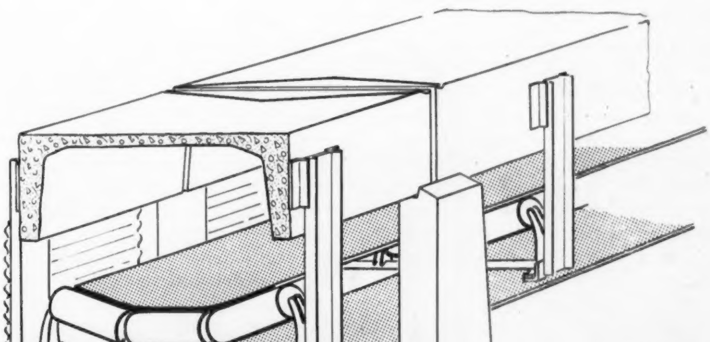


FIG 1. Basic structural system consists of prestressed channel stringers supported by precast U-stands resting on poured-in-place footings.

Conveyor system makes sharp turn so that one flight of belt (moving from right to left) rises to be in position to deposit load on other belt, which moves load toward the viewer. Dust recovery units are installed at each transfer point. Accumulated material is then redeposited on the belt system.

concrete girders. In this final section the girders rest on four-legged towers about 30 ft high, instead of on the single-column, T-shaped piers used at other crossings in the system.

These reinforced concrete towers consist of four round columns braced by three layers of horizontal struts. They have legs battered transverse to the conveyor centerline.

The entire tower rests on a single spread footing. The complexity in the design and construction of these towers was caused by the height necessary to clear the railroad and by the overturning effect of wind loads. The magnitude of the wind reactions is due to the relatively light loading of conveyor structures, the dead-load reduction due to the use of the lightweight-aggregate concrete in all flexural members, and the large surface areas that result from the long spans used in the conveyor system. However, these disadvantages were minor in relation to the advantages gained from lightweight-aggregate concrete.

All the structures were designed for a wind of 100 mph in accordance with the requirements of the American Railway Engineering Association and the American Standards Association. Because of the wind guards, stringer depth and girder depth, the surface areas presented to the wind are quite large and therefore, in conjunction with the long spans, create rather severe wind reactions.

Where it was not necessary to provide the extra clearances required by railroads, it was possible to utilize single-column, vertically cantilevered bents with a T cross-arm to support the conveyors and walkways. These columns, with a single spread footing, were stable under the design wind load —and more economical where lower clearances were permissible.

The most unusual structure in the system is the support tower for the drive machinery at the discharge end of the last conveyor unit of the system, and required by the clearance restrictions already mentioned and a descending grade. This reinforced concrete tower was designed for several purposes —to support five tons of moving machinery offset about 10 ft from the center of the conveyor and its structure; to cantilever forward 13 ft, while supporting about two tons of machinery and the discharge chute; to resist a horizontal belt pull of five tons applied intermittently at the top of the 35-ft-high structure; and also to provide support for the final pair of girders carrying the belt conveyor. All of this was complicated by severe limitations of ground space at the foot of the tower. In addition, an access platform for the machinery was necessary and was to be designed for the heavy live load of 100 psf with an additional 30 psf of snow load. The structure was also subject to the 100-mph wind loads under dead-load conditions, requiring that the final span be shortened to 53 ft 5 in.

In its finished form, the support tower is essentially a vertically cantilevered I-beam of varying section with cantilevers extending in three directions from the top, and a footing offset in two directions to equalize bearing pressures under normal loads. The platform loads are all eccentric, but the platform is so oriented that under snow loading the tower becomes more stable instead of less.

To accommodate the belt pull and the expected deflection of the tower, an expansion bearing is provided at the platform under the ends of the main girders that support the conveyor. To avoid adding the complex belt take-up loads to this terminal tower, an adjacent intermediate tower was utilized to support the counterweights. Besides compensating for belt take-up, the counterweights serve to equalize the load differential between the long and short spans on each side of their tower.

The post-tensioned and pretensioned girders, as well as all the pretensioned channel conveyor stringers, precast concrete decking, and precast diaphragm spacers, are of lightweight-aggregate concrete with a strength of 5,000 psi at 28 days. The lightweight-aggregate concrete was an 8-bag mix containing $5\frac{1}{2}$ gal of water per sack of cement, using expanded shale aggregate of $\frac{3}{4}$-in. maximum size and an air-entraining agent for workability. In addition, the specifications required the use of not more than 2 cu ft of concrete sand per cubic yard of concrete to control volume change and to reduce the harshness of the mix. This mix produced a concrete with an air-cured field density of 105 lb per cu ft and an average 14-day strength of 5,760 psi.

Excellent results were obtained with this lightweight-aggregate mix as far as use, appearance and consistency were concerned. The variation in cylinder strength for the precast units was remarkably small because of plant control of batching, mixing, placing and curing, but for the field-poured sections there was a wide variation as a result of weather conditions, which ranged all the way from winter to summer. All field-poured concrete was a 6-bag mix with 5 gal of water per sack of cement, $1\frac{1}{2}$-in. maximum-size stone aggregate, and 3,000-psi design strength.

Successful mating of precast and field-poured concrete and steel work and the unique designs adopted for structural and esthetic reasons made the field pouring operations somewhat complex. The subcontractors displayed considerable ingenuity in providing

forms for the structures and in complying with field engineered control points. This work was done by a joint venture of the Hunter Construction Company of Ada, Okla., and Frank Newell & Son of Muskogee, Okla., who were also subcontractors for the earthwork in the project. All precast and prestressed concrete units were fabricated by the Thomas Concrete Pipe Co. of Ada, Okla.

Terminal foundations

The head-terminal drives of the conveyors, other than the final drive previously mentioned, are mounted on concrete mat foundations 2 ft thick. These resist the horizontal pull of the belts and also carry the eccentric loads of the drive machinery and counterweight towers, which are offset to one side of the conveyor.

The terminal foundation for the 2¼-mile-long conveyor fell on the side slope of the largest creek bottom land in the project. The foundation was required to resist a horizontal belt pull of 25 tons applied 15 ft above grade, and in addition to offer support to the 300-hp motor and drive and to 50 tons of counterweight and tower, all offset from the conveyor centerline. The finished grade at this point was 10 ft above the original ground level, and since the foundation with its superimposed loads weighed more than 400 tons and was more than 100 ft long, it was not desirable to place these massive and important loads on new fill. Accordingly, the foundation was supported on drilled, belled concrete piles extending down to a benched area of undisturbed earth. With this arrangement the foundation and machinery cannot tip or twist out of line as a result of consolidation of the fill or differential settlement due to unequal bearing pressures. Soil investigations throughout the length of the project indicated no other unusual design conditions.

The entire system is on a right-of-way belonging to the Ideal Cement Company, with easements across railroads and highways. The right-of-way strip is 100 ft in average width, fenced on both sides throughout its length. Contained within this right-of-way is a 40-ft-wide earth roadbed for the conveyor structures with its attendant drainage facilities, a 4,160-v electrical power-transmission pole line from mill to quarry, and a stone-surfaced access road 16 ft wide for vehicular transport and inspection.

At six points along the route, provision is made for the passage of cattle and farm equipment over the conveyor line. The crossovers are fenced on both sides all the way to the right-of-way fences, except across the access road, where cattle guards are provided.

Operation of conveyor

When the belt-conveyor "start" button is pressed, the conveyor unit closest to the mill (the discharge end) starts immediately. After its tail pulley has reached about 50 percent of normal operating speed, a relay starts the next conveyor unit in the line. This in turn, when its tail pulley reaches about 60 percent of operating speed, starts the one ahead of it, and the sequence is repeated for each unit in the system until the first conveyor unit at the quarry end is in operation. The starting procedure requires about seven minutes when the system is started up under load. To unload the system this cycle occurs in reverse, each succesive conveyor stopping in progression toward the mill end.

In the event of power failure or any stopping of the system while fully loaded, the sequence of progressive stopping will occur regardless of the difference in lengths and grades of the separate conveyor units. This sequence is absolutely necessary to prevent the piling up of material at transfer points since material is being fed through at the rate of 17 tons per minute, or about 0.3 tons per second. To control the progressive stopping in sequence of regenerative sections in the event of runaway speed, electromagnetic brakes are provided on the tail pulleys best located to control stopping. Critical speed changes are transmitted through the tail pulleys and the preceding sections stopped while the remaining sections toward the mill continue to run until the system empties itself or is manually stopped. To control the progressive stopping in sequence under normal load conditions, some drives are disengaged by electric clutches and coast under the control of a flywheel while other drives coast under the control of the drive motor and the tail brake.

The system is designed for operation eight hours per day, five days per week, 52 weeks per year, under temperatures ranging from 10 to 116 deg F. The equipment is suitable for longer hours of operation provided adequate maintenance and care consistent with the operating periods is provided.

Design, fabrication and construction were under the direct supervision of Ideal's engineering department in close cooperation with Link-Belt Co.'s equipment and power transmission products division. The Link-Belt Co. handled the prime contract for the installation, with major component subcontracts as listed below.

Subcontracts

Drainage, earthwork design and field engineering—Geo. G. Toler Engineering Co., Oklahoma City, Okla.

Electrical power-line design—Bernard Johnson & Assocs., Houston, Tex.

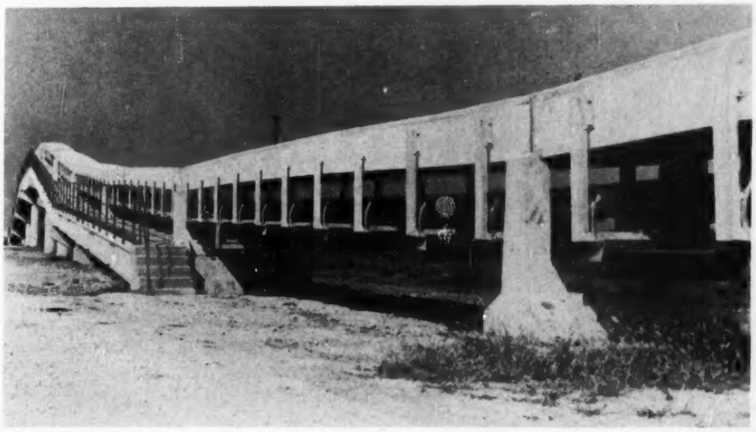
Soils investigation and concrete testing—Oklahoma Testing Laboratories, Oklahoma City, Okla.

Electrical construction (all)—Reynolds Electrical and Engineering Co., Santa Fe, N. Mex.

Conveyor belting—B. F. Goodrich & Co., Akron, Ohio

Conveyor drive motors—Allis Chalmers Mfg. Co., Milwaukee, Wisc.

Conveyor belt is shown arching over a highway. A 1,000-ton cargo is delivered at the plant every hour on the 5½-mile-long conveyor belt. When the system is fully loaded and running, the belts keep a 1,000-ton load in motion—a capacity equivalent to 20 loaded 50-ton railroad cars. The belts travel 500 ft a minute and span two highways and two railroad lines in route from the quarry.



Engineers, atomic physics, and mathematics

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In the past few years more and more articles dealing with the professional status of the engineer have appeared. Many apparently stem from certain inner conflicts that psychologists might call inferiority complexes. A casual perusal of articles by lawyers and physicians shows no comparable anxiety regarding "status." A lawyer does not wonder, aloud, whether his work is "professional" in nature, nor does a physician question whether his routine as a specialist in a narrow field separates him from his "profession" and regulates him to the status of a mere "technician." Apparently the only educated people who do such soul searching are engineers. Why do they waste time in such unprofitable self-analysis?

Anxiety about status

The physicians and the lawyers have conferred professional status upon themselves and the public has accepted their evaluation. Engineers have also conferred professional status upon engineers, but in doing so they have not convinced themselves. The public would have accepted their claims even as it did those of the lawyers and the physicians but the engineers would not have it that way. Instead they have dragged out an issue where no issue is apparent, and even created issues in some cases. Engineering societies have written elaborate definitions concerning what constitutes a "professional" man and how he differs from a "technician." On this basis engineers have proceeded to take one another to task and to weigh their fellows on artificial scales of their own making.

I know of no people, except engineers, who are unwilling to accept engineers as professional men. It is as though engineers, fearful of the status they have conferred upon themselves, are trying to talk themselves out of it. In this they may be successful. If a dermatologist were to write tearful manuscripts to his medical journal bemoaning the fact that his practice had become so narrow that he was now merely a technician and no longer a professional, then I would have to go along with him, on his own say-so. If a corporation lawyer, specializing in labor legislation, were to write to his journal that his work had been narrowed so much that he was now only a highly paid clerk, a technician, and not a professional man, then I would accept his own evaluation of himself. I would feel that these two people were very stupid to impair their professional standing with me just for the sake of cultivating their inferiority complexes, but if they insisted on removing themselves from the ranks of their professions I would have to go along with them.

What makes a professional man?

In criteria for judging what is professional and what is not there are variations without number. In general the idea is that a professional man should be required to use training and judgment; that he should be adept at planning, not just a follower who does routine tasks. Well, I submit that by such criteria many plumbers, electricians, bricklayers, carpenters, and machinists qualify as professionals.

Anyone who believes that technicians do only routine tasks, leaving all the judgment and planning and intricate thinking to some professional in the background, just hasn't been around very much. Perhaps a few months devoted to working with both electronic technicians and research physicists might affect his judgment concerning just what judgment and thought and planning really are.

More than thirty-five years ago, when I was given a card and license as a journeyman machinist, I was told that now I was a skilled worker who was supposed to use intelligence and judgment, and be capable of planning projects and carrying them out. Some years later I was surprised to find my engineering societies claiming these attributes as peculiar to professional men. I could only conclude that the makers of these new rules hadn't been around very much. I, as a machinist, was willing to accord professional standing to myself as an engineer, without resorting to a lot of bogus classifications in an attempt to set workers apart.

So now as an engineer for some thirty-five years I am more amused than resentful when some member of my profession tries to lose his professional status by pointing out his own shortcomings. I do not fear that some physician will say: "This week I extracted tonsils from thirty people and I, as a professional man, resent the conferring of professional status on that civil engineer who is engaged in land surveying down in Brewster County, Texas." I do not believe any physician would say that, or think it. Rather it would remain for an engineer with a well cultivated inferiority complex to make the statement or think the thought.

I, as an engineer who has surveyed land in Brewster County, will grant that thirty tonsillectomies involve the

use of judgment and planning and knowledge. And any civil engineer who has seen a map of the weird block-system of land in southwestern Texas will know that he had better have his planning, judgment, and knowledge in good working order there also. The tasks are no less difficult; they are just different.

Abstract mathematics

In recent years some engineers, engaged in a search for more fuel for their inferiority complexes, have decided that a person cannot possibly become an engineer unless he has a wide knowledge of abstract mathematics. Such people will insist that the calculus is not a fit stopping place in the formal mathematical treadmill; that 25 semester hours of mathematics are insufficient for the person who would go out to design bridges or build highways. Maybe so; maybe not.

I cannot speak with authority on how much mathematics is needed to qualify a man as an engineer. I do know that eighth-grade arithmetic is handy; that plane geometry, algebra, and trigonometry are useful; that a general knowledge of some calculus helps in interpreting some formulas. Over and above that I am not too sold on the idea. I have only 60 semester hours of mathematics myself. If I have not been called upon in thirty-five years of engineering practice to use non-Euclidean geometry, Boolean algebra, advanced calculus, or wave mechanics, it is probably because my work has been confined to civil and mining engineering, not to the design of flying saucers and space ships.

The problem of atomic physics

Recently I have read articles stating that an engineer cannot be classed as such unless he has training in atomic physics. Just what type of "atomic structure" should the engineer learn? The type that was taught in 1921, or the later varieties taught in 1929, 1935, 1944, 1949, 1953, or 1959? Yes, I have taken that many "courses" in the intricacies of the atom. It started out being a two-particle affair and has now acquired a structure consisting of a dozen or more particles, with new ones being found each year to account for some newly discovered discrepancy. Once again we have applied a lot of complicated mathematics to a structure we do not understand. I wonder what this so-called atomic structure will be in 1969. I am fairly sure of one thing: it will not be the same as it was in 1959.

Just how necessary is it for a civil engineer or a mining engineer or an electrical, chemical, or mechanical engineer to "know" about atomic physics? First of all, what is this "know"? I certainly do not "know" about atomic physics after those seven courses in it, taken over the past 39 years. A good many years ago an atomic physicist stated that "Making atomic models from atomic spectra data was like constructing a piano from the noise it made as it fell downstairs."

May it not be that we, in our study of atomic physics, have taken ourselves too seriously? I do not belittle the study of physics for engineers. However, we should not make a great god out of physics any more than we should deify mathematics. Certainly I cannot go along with anyone who believes that the rank of "engineer" should be conferred only on those who have done work in advanced mathematics and atomic physics.

I am especially concerned over the idea that the undergraduate should devote most of his preparation in civil engineering to majors in mathematics, chemistry, physics and geology. It so happens that I have majors in each of these fields. Geology is very helpful to the civil engineer, who must build his structures on enduring foundations; physics is a fine study upon which much civil engineering is based, but it is not necessary to be an expert in the current idea of atomic structure in order to become a good civil engineer. Chemistry is a worth-while study in itself, but I doubt that any great knowledge of it is necessary to the civil engineer. Mathematics is a wonderful tool but it is only a tool; it is not a god to be worshipped.

What civil engineering is

The civil engineer does much of the construction work of the world. He, probably before all other engineers, translates the scientific thought of the world into structures of practical use and enduring value. His value, and his professional status, will depend upon how adept he is in the actual practical techniques of civil engineering.

It is time that the engineer awoke to the fact that professional status is his and has been his for years; that it was gained by the practice of engineering and not through an exhaustive knowledge in other fields, however closely related to engineering.

We will be making a big mistake if we throw aside training in our chosen field, which we know does work, for dives into related fields that contribute little to the problems we must solve. Engineering is still a matter of handling men, machines, and materials and getting the most out of them for the dollar.

AISC AWARD HONORS PHILADELPHIA BRIDGE

At a recent meeting of the Philadelphia Section of ASCE, the American Institute of Steel Construction honored the designers, owners, and builders of Philadelphia's Vine Street Bridge with an award. Shown here, in usual order, are S. C. Weikert, district engineer of the Pennsylvania Department of Highways; J. H. Rowland, director of the AISC and president of the Phoenix Bridge Company; ASCE Past President Francis S. Friel, who made the presentation; and ASCE Honorary Member Frank Masters, Harrisburg consultant.

ASCE NOMINATES OUTSTANDING PROJECTS

Twelve civil engineering projects have been nominated by ASCE Districts for the "Outstanding Civil Engineering Achievement of 1959." Some of the Society's fifteen Districts decided not to make a nomination. Judged by a jury of eight engineering magazine editors, the winner—the most outstanding achievement—will be announced by the Board of Direction at the New Orleans Convention in March.

The nominations by District are as follows:

Oak Street Connector—This highway link, located in New Haven, Conn., connects New England traffic, moving north and south over the streets and railroad tracks of a major city. It is the nomination of **District 2.**

St. Lawrence Project—This joint project of the United States and Canada involves both dam construction for power and water control, and canal and lock construction for ocean commerce into midwestern United States. The new power plant in the project has a rated capacity of 1,880,000 kw. Four new locks open the Great Lakes to four-fifths of the world's shipping. The St. Lawrence Project was nominated by **District 3.**

Torresdale Water Treatment Plant—This plant, one of the two largest water treatment plants in the United States, was built to serve the city of Philadelphia's 2,200,000 inhabitants, at a cost of $25,000,000. It is "push button" operated, being interlaced with automatic controls for the water flow, chemical feeding filtration rate, and the use of its facilities. It is the choice of **District 4.**

Allegheny County Sewage Disposal System—This project, the choice of **District 6,** cost $100 million and is serving the city of Pittsburgh and 69 surrounding communities. It involves 69 miles of intercepting sewers, six sewage lift stations, and a central treatment plant with a rated capacity of 150 mgd, and a maximum capacity of 300 million gallons.

Oahe Dam—Located on the Missouri River six miles upstream from Pierre, S. D., Oahe is 9,300 ft long and 242 ft high. It is claimed that Oahe is the world's largest rolled earth dam. Behind the Oahe embankment, the Missouri River forms a 250-mile reservoir which, at full pool, will contain 23,600,000 acre-ft of water. **District 7** nominated Oahe Dam.

Executive House, Chicago—A 39-story reinforced concrete apartment house constructed just north of Chicago's Loop District. The 371-ft height of Executive House makes it the tallest reinforced concrete structure of its kind in the United States. This fact, and its unique design, resulted in its nomination for the competition by **District 8.**

Scioto Downs—**District 9** has nominated the grandstand at the Scioto Downs racetrack, nine miles south of Columbus, Ohio, said to be the world's largest inverted umbrella concrete roof. Its main feature is its tilted thin-shell concrete roof composed of five hyperbolic paraboloid shells, with each shell resting on a single column of reinforced concrete 36 in. in diameter.

Wilson Lock—A new large lock, built into the existing Wilson Dam at Muscle Shoals, Ala., by the Tennessee Valley Authority, Wilson has a lift of 110 ft, probably the world's highest single-lift. Related improvements include construction of a new high-level highway bridge of curved girder design and the lowering of the three-mile Florence Canal 10 ft, using a unique method of shifting the channel to keep river traffic moving. **District 10** nominated Wilson Lock.

Vandenberg Air Force Base—A major U. S. Air Force Base, located in California (Los Angeles), Vandenberg was nominated by **District 11** mainly because of its Atlas and Thor launching facilities. **District 11** also nominated **Glen Canyon Bridge,** which is near the Arizona-Utah border, spanning the 1,200-ft-wide gorge of the Colorado River at the Glen Canyon Dam site.

Priest Rapids Dam—On the Columbia River in central Washington, Priest Rapids Dam is a reinforced concrete and earthfill structure, with an overall length of 10,138 ft and a maximum height of 178 ft. A factor in its nomination by **District 12** is that it was completed a full year ahead of a tight construction schedule.

Wichita-Valley Center Flood Control Project—Because of this project, the metropolitan area of Wichita, Kans., is now said to be as nearly flood-proof as man can make it. It involved the construction of 93 miles of levees to connect the channels of the Big Arkansas River and the Little Arkansas River and their tributaries, as well as the construction of 40 miles of river channel. It is the choice of **District 16.**

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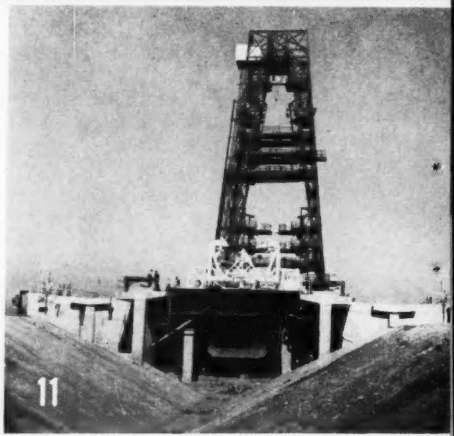

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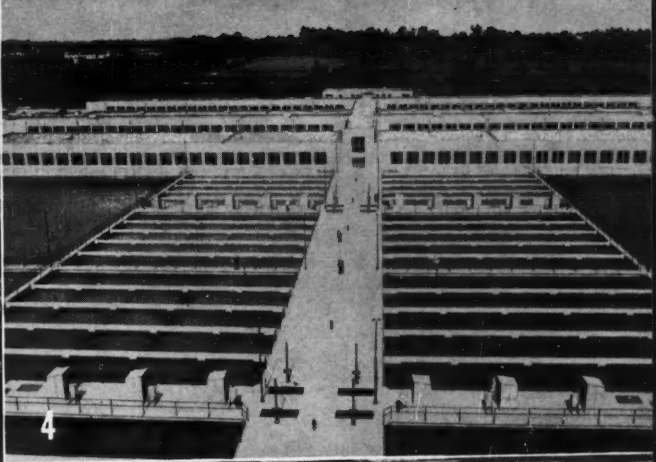
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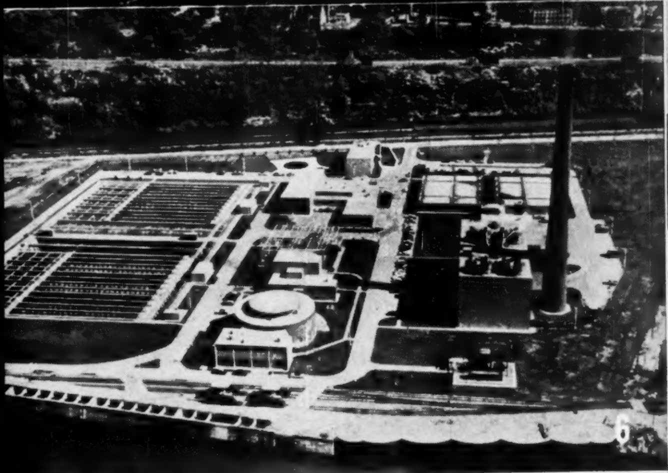
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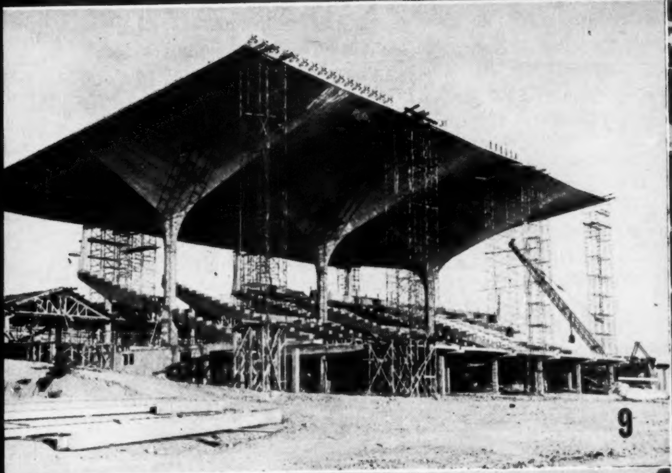
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Thermal electric stations in Japan

O. D. IDES, Supervising Concrete-Hydraulic Engineer, Ebasco Services Incorporated, New York, N. Y.

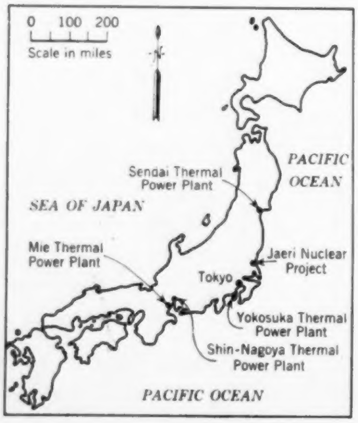
R. T. RICHARDS, M. ASCE, Civil Engineer, formerly with Ebasco Services Incorporated

Contractors doing construction work on Japan's new thermal electric power plants are faced with a variety of problems—many different from those usually encountered in the United States. Typhoons and earthquakes are ever present threats in Japan, with the result that design loads are far higher than those used in normal practice.

Since 1952 Ebasco has been actively engaged in the design of five conventional fuel steam power units at four sites in Japan. See Fig. 1. These five units (Table I) have a rated total capability of 882,250 kw and are the initial units of plants with a presently planned total capability of over 2,800,000 kw.

In addition, the authors' firm is designing a 12,500-kw demonstration nuclear project for the Japan Atomic Energy Research Institute. This plant, also located in Fig. 1, employs a boiling-water reactor and is scheduled for completion in 1961. It is interesting to note that power plants southwest of Tokyo generate at 60 cycles. Those in Tokyo and north of that city are 50-cycle plants.

FIG. 1. Thermal electric power plants are rapidly overtaking water power in Japan's expanding industrial economy. The location of five of these developments is shown.



Thermal electric power plants are relatively new in Japan but they are rapidly overtaking water power in Japan's expanding industrial economy. Until the mid-1950's, hydroelectric power was the staple of Japanese power supply. However, in Japan, as in many other industrial nations, the demand has far outstripped the available economic water supply potential. The Tokyo Electric Power Company, largest of Japan's nine private power companies, plans to add over 4.4 million kw of thermal power to its system between 1956 and 1966. Seventy percent of Tokyo Electric's capacity will be thermal as compared with 37 percent in 1957. Most other Japanese companies are similarly expanding in the thermal power field.

The prime contractor for all these units, including the scheduled nuclear project, is the International General Electric Company (IGE). This company contracted with Ebasco Services Incorporated to provide engineering, design and construction inspection services in connection with foundation, structural, mechanical and electrical plant features. In each of these fields, Japanese engineers retained responsibility for some phases of the design work. Construction is being done by the Japanese with the assistance of Ebasco field engineers.

IGE provided all the turbine-generator units, combustion control and other specialized equipment not readily available through Japanese manufacturers. Where possible, equipment is Japanese. In many cases, the contract for erecting the Japanese equipment was made with the manufacturer of the equipment, a practice not widespread in the United States.

An additional feature common to all plants is the planned method of extension. IGE and Ebasco contracted to design the initial units at each plant with the expectation that some additional units would be designed by the Japanese. A number of these plant extensions have already been completed or are now under construction. These plants include the use of high steam pressures and temperatures, and compare favorably with the most modern in the United States.

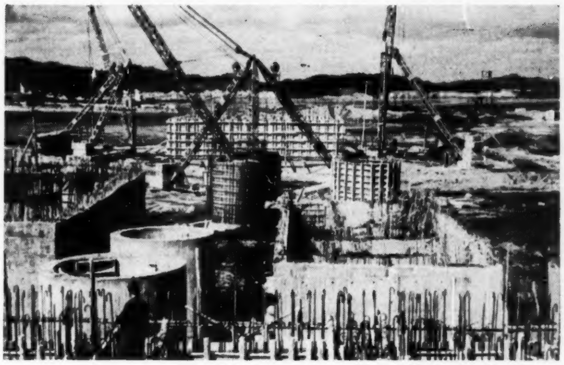
Man-made sites

Thermal plants require large supplies of condenser cooling water, generally available in Japan only at sea level. Sites must therefore be in areas heavily built up through centuries of maximum utilization of land. The need for arable land is so great that courts do not look with favor on condemnation proceedings for the much needed power generating facilities. The sites for all these plants are therefore on rock- or sand-filled areas in tidal waters.

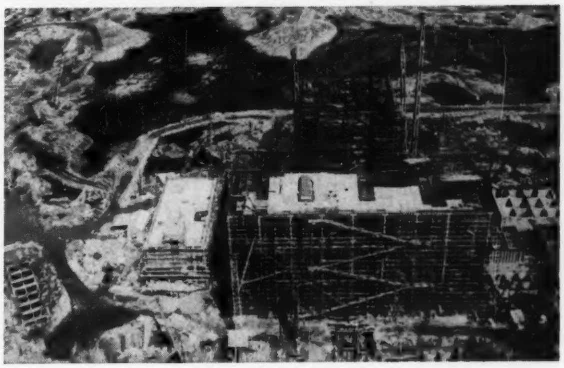
A major consideration in the civil engineering design of all these plants is the ever-present threat of typhoons and earthquakes. Wind and earthquake loadings are far higher than any used in normal practice for construction in the United States.

At the Yokosuka Station the design wind loading from ground level to 82 ft is 60 psf and increases to a maximum of 92 psf at 195 ft, the highest elevation of the plant's main building. This contrasts with normal wind loadings in the United States of 25 to 30 psf and hurricane loadings that rarely exceed 40 psf.

Earthquake loadings are nearly twice the maximum commonly used for de-



Caissons for the Sendai Thermal Power Plant were both circular and rectangular. They were sunk by the usual method of excavation from within.



Construction view of the Sendai Plant shows the station building enclosed in a concentrated network of light scaffolding—a characteristic of Japanese heavy construction.

sign in the United States. For the Mie Plant near Nagoya the design earthquake acceleration was 0.2 gravity, plus 0.02 g for every 13 ft in height over 52 ft. At Yokosuka, the acceleration was 0.2 gravity plus 0.01 g for every 13 ft over 52 ft. The factors for Sendai and Shin-Nagoya were similarly high. Massive continuous concrete mats support the major equipment at all these plants, as a feature of the earthquake resistant design.

Equipment, fuel and materials are delivered to each site by truck or by water on barges or seagoing ships. This method of delivery differs from that at most U.S. installations, where railroad spurs can generally be brought to the site. Japanese railroad rolling stock, bridges and roadbeds are not equipped to handle the very heavy loads involved in the delivery of major equipment. Substantial facilities for ship and barge unloading are therefore prominent civil engineering features at each site.

Yokosuka Thermal Plant

The Yokosuka Plant, ultimately to be one of the largest in the world, is at Kurihama on the southwest shore of Tokyo Bay near the port city of Yokosuka. Unit 1, of 265,000 kw, will be completed late in 1960. See Fig. 2.

The major part of the site is rock fill, supplemented by sandy material dredged from the bay bottom. The rock was obtained from cliffs on the west side of the plant in an unusually large blasting operation. Over 2,300,000 cu yd of rock was removed from an area formerly occupied by a naval fort. The largest single shot, limited to 5 tons of explosives, removed 26,000 cu yd of material.

The main building area was not filled in this phase of construction. Instead, a sheetpile cofferdam was driven to isolate the area from the general fill oper-

TABLE I. Five thermal electric units designed by Ebasco

	Unit No.	Year Completed	Kw	Psig	Deg F	Cycles
Tokyo Electric Power Co.: Yokosuka Plant	1	1960	265,000	2,400	1050/1050	50
Tohoku Electric Power Co.: Sendai Plant	1	1959	175,000	2,400	1050/1000	50
Chubu Electric Power Co.: Shin-Nagoya Plant	1	1958	156,250	2,400	1050/1000	60
	2	1959	220,000	2,400	1050/1000	60
Mie Plant	1	1955	66,000	1,250	950	60

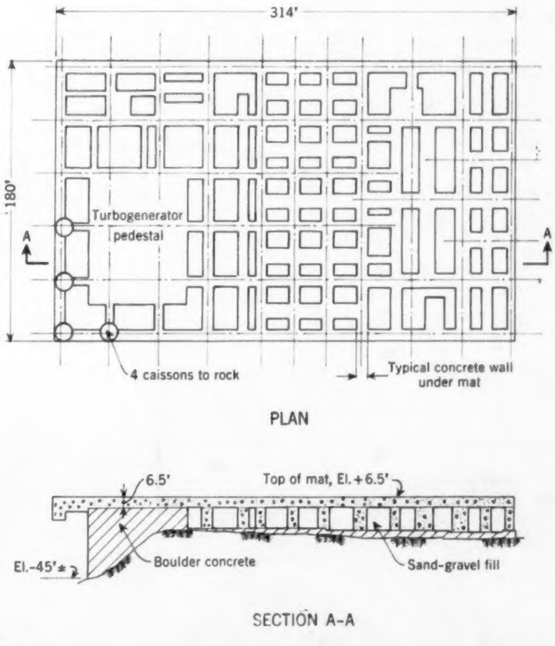


FIG. 2. Yokosuka Thermal Power Plant was built chiefly on rock fill. The main building area, however, was first filled partially with boulder concrete and then the remaining space, up to the building mat, was filled with a network of supporting walls of concrete.

The need for arable land is so great in Japan that sites for thermal power plants are on rock- or sand-filled areas in tidal waters. Shown in photograph is the Sendai Thermal Power Plant under construction.

ations. A ring of watertight fill was placed around the inside of the oversized cofferdam to seal out seepage. Cyclopian, or boulder, concrete was then placed above the natural rock foundation up to levels varying from 7 to 14 ft below the bottom of the main building mat, which is 6½ ft thick. The boulder concrete generally varies in thickness from 1½ to 5 ft, but in one corner of the building, under the pedestal, a sharp drop in rock level required a concrete fill with a maximum depth of about 45 ft. This method of construction was chosen instead of caissons, which are more popular in Japan and which were used extensively for the Sendai Station discussed subsequently. The remaining space of 7 to 14 ft between the boulder concrete and the under side of the mat was filled with a network of concrete support walls. This wall construction, used instead of mass concrete, yields a desirable saving of material at the expense of formwork and labor, an approach frequently encountered overseas. The area under the turbogenerator pedestal was filled solid.

The 265,000-kw turbogenerator of Unit 1, largest in Japan, is a cross-compound unit on a single concrete pedestal. The pedestal for the two parallel machines is 42 ft high and 60 by 82 ft in plan. It was constructed in two equal lifts with a total volume of 2,460 cu yd.

Another notable civil engineering feature is the sea wall which was designed to withstand the heavy pounding of typhoon-driven waters. Many wall types were model tested in the laboratory before adoption of the final design. The interior of the typical cross section is a 23- by 26-ft box caisson resting on a 5-ft bed of broken stone and filled with sand and stone. The sea side of the caisson is protected by a layer of stone followed by a layer of 2- to 3-ton tetrahedrons, topped finally by a blanket of 12-ton tetrapods. As a result of experience in the 1958 typhoons, one exposed corner of the wall was constructed as shown in Fig. 3. A similar caisson wall in several different forms continues around the plant site both to protect the site and to serve as unloading wharves for equipment and fuel vessels. The largest of the wall caissons was 40 ft high and 38 ft wide. All the caissons were constructed off the site and floated into place.

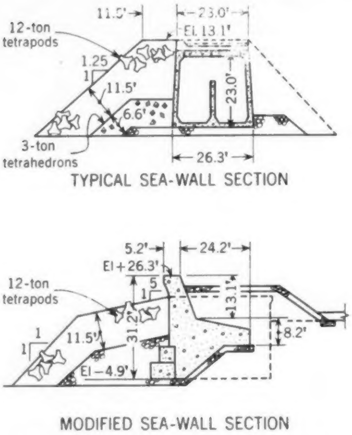
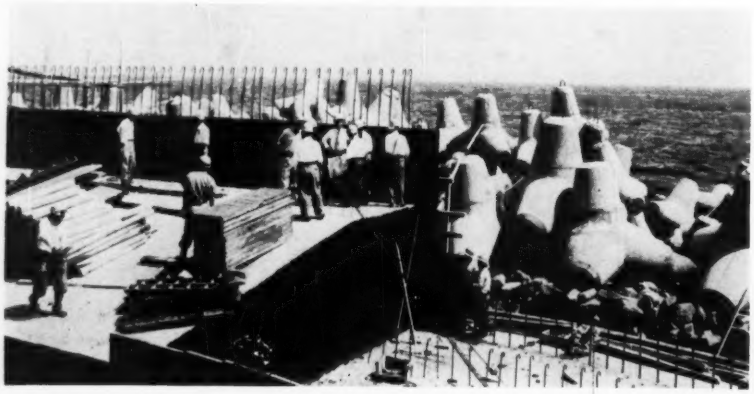


FIG. 3. The sea wall was designed to withstand the heavy pounding of typhoon-driven waters at the Yokosuka Thermal Power Plant. The modified section was used for an exposed corner of the wall after the results of the 1958 typhoons were studied.

Sea wall for Yokosuka Thermal Power Plant is seen under construction.



Yokosuka circulating-water system

The canal, tunnels and structures of the circulating-water system were placed in excavations made after the site filling operations were completed. Water screening and pumping facilities were distributed among three structures instead of in the single intake structure commonly used for stations in the United States. The first structure at the canal entrance contains trashracks to keep the canal free of the large amount of floating debris present in the bay. The concrete-walled intake canal terminates in a screen structure near the north end of the line of four proposed units. The trashrack structure, canal and screen structure were constructed to accommodate a flow of 1,765 cfs for the ultimate installation. Concrete tunnels lead from the screen

structure to points adjacent to each condenser, where they are terminated by pump-chambers of the wet-well type. To serve Unit 1, two vertical mixed-flow pumps of 64,000 gpm are placed in individual chambers equipped with sets of vaned elbows to guide the flow properly to the pumps. The vanes will correct undesirable flow patterns set up at the tunnel curve upstream of the pump chamber.

These vanes are made of 3/4-in. carbon steel, rather than stainless steel or monel, both of which have better corrosion resistance in salt water. It was felt that such extra-heavy vanes instead of the 3/8 or 1/2 in. normally used would give satisfactory performance for many years. When replacement becomes necessary, the entire vane assembly can be chipped out without disturbing the structural concrete. Stainless steel is corrosion resistant in moving water but may corrode badly under bolts and in other places not in contact with a continuous oxygen supply.

The vaned-elbow design is relatively unusual. It was first used by the authors' firm in 1951, and has since given excellent service in a number of stations in the United States. It is being used at both Yokosuka and Sendai, where the tunnel upstream of the pumps curves sharply and upsets the uniformity of flow required for best pump performance. At both stations the shelf created by the upper concrete guide vane provides a semi-separate water chamber for the large ash-water pumps. The combined chamber for circulators and ash pumps is unusually small as a result of the beneficial effect of the vaned elbow setting.

Unusual structural features

The boiler and turbine are totally enclosed in one building to protect equipment against sand and salt spray carried by the typhoon winds. This boiler treatment departs from the United States practice of using a semi-open boiler and has resulted in the use of 5,300 tons of structural steel, possibly a weight record for the enclosure of a single power-plant unit. The building walls are of asbestos-cement flexible sheet siding.

For equipment access, an unusually large rolling shutter door 26 ft wide and almost 40 ft high has been provided in the building. Another steel structure of uncommon size is the 328-ft stack. Japanese engineers favored the use of steel for this relatively high stack, although most United States stacks of comparable height are of concrete.

Sendai Thermal Power Plant

The Sendai Thermal Power Plant, near the city of Sendai on Honshu, is in one of Japan's most famous scenic areas, Matsushima (Pine Islands) Bay. This mountainous area served by the Tohoku Electric Power Company has drawn its power almost solely from hydroelectric plants. At the end of 1957, 1,297,000 kw of hydro generating capacity had been installed. Another 297,000 kw is proposed for completion by 1962. In contrast, only 10,000 kw of thermal power was available at the beginning of 1958 when construction of the Sendai Thermal Power Plant was begun. Unit 1, now in operation, is for 175,000 kw. Unit 2, now being designed by the Japanese, will also supply 175,000 kw.

The Sendai plant site was reclaimed from the bay by dyking the area and filling with material dredged from the adjacent Shiogama Ship Canal and cut from nearby hilly areas. The entire site was initially filled to grade about 11 ft above mean sea level and about 1 ft above the highest recorded water level.

All major building loads are carried on a single large mat from 5 to 8 ft thick and about 250 ft along its maximum dimension. The mat is supported on caissons sunk through the fill to rock at a maximum depth of 60 ft. Rock in this area is a compacted volcanic material or tuff with an overburden of silty clay topped by silty sand and shell, part of which was placed by dredge.

The caissons, which are both circular and rectangular, were sunk by the usual method of excavation from within. The concrete walls were built up as the caissons sank. The deepest single caisson, 72 ft from grade, is an individual foundation supporting the 298-ft concrete stack. Air chambers and air locks were required for many caissons with bottoms resting 45 to 50 ft below the water level. The use of caissons, clearly advisable here, is generally favored by Japanese construction men even in areas where United States engineers may prefer to excavate and unwater. Japanese contractors are particularly adept at the caisson type of construction.

The circulating-water intake structure and tunnels were also of caisson construction but were carried only to the elevation required by hydraulic and cover considerations. The caissons are supported on wood piles driven to rock.

An accompanying photograph shows the station building enclosed in a concentrated network of light scaffolding, another characteristic of Japanese heavy construction. These scaffolds are made primarily of cedar poles lashed together with wire. It is doubtful whether the safety standards of the United States construction industry would be satisfied either by the scaffolding or by the precarious light ladders, ramps and rigging used by the nimble Japanese workmen.

For the Sendai circulating water system, the trashracks, traveling screens and screen wash pumps are located at the end of a short intake canal. Concrete tunnels carry water about 1,400 ft to circulating pump bays adjacent to each condenser. As at Yokosuka, the circulating-water pumps are mounted above sets of vaned elbows to correct the undesirable hydraulic conditions created by the sharp approach angle to the pumps. Stainless steel vanes were used in this case. Reversing valves at the condenser permit backwashing to clean the tube sheets. Although each circulator with its condenser shell is separate from the next, a valve permits cross connection to give maximum versatility. The circulating-water piping is steel, coated inside with 1/4 in. of enamel to resist corrosion from the salt water.

Boiler make-up and service water is stored in a reservoir about a mile from the plant site. The fresh-water supply comes both from wells and from a surface source 10 miles southwest of the reservoir. Water is pumped through a 10-in. concrete supply line by two booster pumping stations.

Demonstration nuclear reactor

Design is under way for a 12,500-kw boiling-water demonstration reactor for the Japan Atomic Energy Research Institute near Tokai-mura north of Tokyo. Present plans for this center of Japanese nuclear research call for an ultimate total of seven demonstration reactors and at least two large commercial power reactors. The first commercial power installation at the site may be a British-built 150,000-kw gas-cooled Calder Hall reactor, probably to be constructed concurrently with the first demonstration unit.

Through necessity, the Japanese have turned from hydro to thermal power and have done so in earnest. Their rapidly expanding industrial economy is now pushing ahead with the help of some of the most advanced thermal power installations available in the world today. The authors' firm, long involved in the development of hydro capacity in Japan, has found its work with the Japanese in these new installations an interesting departure from many features of American practice.

(This article is based on the paper presented by Messrs. Ides and Richards at the ASCE Annual Convention in Washington, D.C., before the Power Division session presided over by George R. Standberg, a member of the Division's Executive Committee.)

ASCE Sanitary Engineering Conference

SUBJECT: POLLUTION ABATEMENT

"Pollution" is an ugly word. The thinking man is relieved when the word is accompanied by another, "Control," which is fairly common, or "Abatement," which is less common but more accurate. Civil engineers, working hand in hand with several other professionals, are quite sure they have the technique necessary to effect much abatement of certain types of pollution. However they feel they lack public understanding of the problem, appreciation of the esthetic and public health aspects of abatement, and public support to undertake known abatement processes.

Of course this is an oversimplification, but it does sum up the conclusions of engineers attending the Society's recent three-day Conference on Pollution Abatement. Because this conference was conducted by the Sanitary Engineering Division, with supporting sponsorship of the Cincinnati Section, the Robert A. Taft Sanitary Engineering Center, and the University of Cincinnati College of Engineering, it had a strong engineering flavor. But not entirely so. As Dr. Abel Wolman said in summing up the conference findings, "Sanitary engineers must recognize a multi-discipline approach to solutions."

After listening to two and a half days of prepared papers and spontaneous discussion, Dr. Wolman listed seven tasks for engineers concerned with the abatement of pollution of air, land and water:

1. The task of defining criteria. This is necessary if the Tower of Babel approach is to be avoided.
2. The task of translating such criteria into realistic design.
3. The task of translating such criteria into performance. (It is one thing to design or construct an adequate facility, and another to operate the facility consistently and properly.)
4. The task of maintaining equilibrium between costs and social benefits. (Dr. Wolman warned against the "Madison Avenue approach" of disregarding the value of the product.)
5. The task of facing the relationship of esthetics and functions. In his concern for function, the engineer has sometimes disregarded esthetics and earned the blame for "uglification."
6. The task of restraining extravagant promises or threats in the drive to gain public support.
7. The task of recognizing the multi-discipline approach to solution of abatement problems.

Continuing his summation, Dr. Wolman cited the strong competition pollution abatement faces for public support, public acceptance, or even public understanding. The average taxpayer is much more interested in consumer goods, medical care, schools, military capacity, or even highways or reclamation projects. There is need to sell the esthetic values of improved environment, as well as the public health values.

Several conference speakers had described new pollutants which are micro-chemical, in addition to the micro-biologic which have become familiar. Dr. Wolman listed, as an immediate need, research on the nature of detection of and the significance of such chemical pollutants. Until such research has produced results, it is too early to alarm the public.

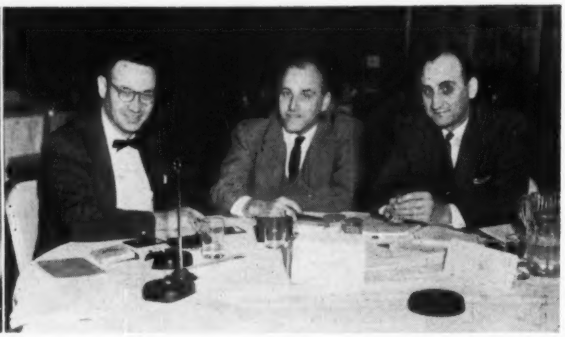
Tons of Chemicals

Despite the restraint urged, almost every speaker made some reference to this new unknown. The first to bring up the matter was Dr. Mark Hollis, Assistant Surgeon General. Dr. Hollis called attention to the millions of tons of indusrial wastes, insecticides, fungicides, weed killers, etc., which are being poured forth on the land, into the air, and into the water. ASCE must accept an active position of leadership, he said, in

1. Finding agreement on terminology.
2. Conducting needed research.
3. Establishing suitable parameters of pollution.

In this, increasing tempo is needed or, as Dr. Hollis put it, "we must run faster to stay in the same place." The U. S. Public Health Service has compiled a list of 280 research projects now

Executive Committee of Sanitary Engineering Division proposes new program during recent Cincinnati meeting. Shown, in usual order (left-hand view), are S. B. Baxter, J. J. Baffa, H. L. Thompson, D. H. Howells, A. D. Caster (conference host), Division Chairman L. A. Young, and R. E. Lawrence. Right-hand photo shows members of Committee on Sanitary Engineering Aspects of Nuclear Energy reporting. They are W. J. Kaufman, Chairman J. G. Terrill, Jr., and E. J. Gloyna.



in operation, with much more work needed on exotic chemicals.

Air Pollution Increases

A panel moderated by Vernon G. MacKenzie, of the USPHS, summed up the current status of air sanitation activities. The summary was presented by Richard E. Hatchard, chief of air pollution control for the State of Oregon. Why these studies and the discussion of appropriate abatement constitute a sanitary engineering problem was explained by William T. Ingram, New York consulting engineer, who is also chairman of the ASCE Committee on Atmospheric Pollution. Dr. Ingram described the functions involved in realistic abatement programs. On the panel also was Dr. Harry G. Hanson, director of the Robert A. Taft Sanitary Engineering Center. Dr. Hanson described the work under way at this research center in Cincinnati, the details of which will be available later.

Refuse Disposal Costs Mount

A second panel examined the practical problems of land pollution from man's refuse. Moderated by Morris H. Klegerman, consulting engineer, the panel included F. R. Bowerman, of the Los Angeles County Sanitary District; William A. Xanten, of the District of Columbia Division of Sanitation; Leo Weaver, of the American Public Works Association; and Casmir A. Rogus, of the New York City Department of Sanitation.

There was a time when man could pick up and move whenever his refuse piled too high about his tent. That such a situation is long since past was described graphically by Mr. Bowerman. As the solid refuse of our cities increases, it becomes more and more costly to cart it about, as available dumping sites get filled up or built on, and increased concern over air pollution restricts burning. Thus, the need for good engineering increases. Trends in land reclamation and incineration were discussed.

Water Quality Studies Well Advanced

The third general panel was devoted to examination of the aspect of pollution abatement which receives the most attention, water pollution. Sound data, effective processes, and good engineering were reported by this panel, which was moderated by Gordon E. McCallum, chief of the Division of Water Supply and Pollution Control of the USPH. The only trouble is that there are not enough installed treatment plants or abatement works. Here, too, public support is needed for new legislation and financing.

The Conference presented a good opportunity to study at first hand what could be done with a lot of hard work and inspired leadership. Cincinnati is home base of the Ohio River Valley Water Sanitation Commission. This eight-state grouping has, in one decade, effected the installation of plants treating sewage of 95 percent of the population along the Ohio River. Also, substantial progress has been made in curbing the discharge of industrial waste. The Executive Director of this Commission, Edward J. Cleary, was chairman of the closing session of the Conference, which accomplished the summation. Those who could then visited the remarkable new Mill Creek Sewage Works, as guest of the conference chairman, Arthur D. Caster, who, is also principal sewage disposal engineer for the City of Cincinnati. Another tour visited the Robert A. Taft Sanitary Engineering Center, to study the Air and Water Pollution Laboratories.

The "status of the art" reports on water pollution were given by William C. Ackermann, chief of the Illinois State Water Survey; Prof. Gerald Rohlich, of the University of Wisconsin; and Dr. Louis Koenig, research consultant of San Antonio.

Two featured conference addresses are briefed elsewhere in this issue. Executive Secretary William H. Wisely spoke to a dinner gathering. His thought-provoking description of "ASCE and the Future" was geared to the spirit of the conference—planning ahead for progress. The second was presented to the opening session by Theodore M. Schad, staff director of the Senate Select Committee on National Water Resources, sometimes called the "Kerr Committee." Mr. Schad presented the first report to ASCE of this far-reaching study now underway to set criteria for water resources policies of the U. S.

Held January 6 through 8, at the Netherland-Hilton in Cincinnati, the conference was organized and conducted by a committee under the chairmanship of Arthur D. Caster. Other committee members were Bernard B. Berger and Ray Raneri, assistants; Hayse H. Black, chairman of local arrangements; Cornelius Wandmacher, publicity chairman; and Arthur C. Andrews, Jr., president of the Cincinnati Section.

Salvaged Water Is Best New Source

Speaking at the Sanitary Engineering Division Conference, held in Cincinnati early in January, Theodore M. Schad, staff director of the Senate Select Committee on National Water Resources, outlined progress made to date by the committee, which was established by a Senate resolution in April 1959. This special committee will consider the nation's water resources problems, which at present are divided among four standing committees of the Senate.

The Public Works Committee handles legislation dealing with navigation, flood control, pollution abatement, and some of the power programs. The Interior and Insular Affairs Committee handles the multi-purpose Federal Reclamation Program, as well as the Geological Survey and public land matters relating to water and certain power legislation. Legislation dealing with the Federal Power Commission's activities and with the Fish and Wildlife Service is the responsibility of the Interstate and Foreign Commerce Committee. The Committee on Agriculture and Forestry handles the small watersheds programs of the Department of Agriculture, involving reservoirs smaller than 4,000 acre-ft. Still other committees handle other programs—for example, the St. Lawrence Seaway Project and the Water Resource Program of the International Boundary and Water Commission, which involves Mexico.

The Senate resolution, establishing the new Committee, directed that it study the extent and character of water resource activities, both governmental and non-governmental, that will presumably be required to provide the quantity and quality of water needed until 1980 for use by the population, agriculture and industry, along with suitable provision for recreational and fish and wildlife uses. Studies are to be transmitted to the Senate not later than January 31, 1961, after which the Committee will cease to exist. Because this is an election year every effort is being made to complete the report by July 15. The Committee was given $175,000 to finance its operation through January 1960. Dr. Edward Ackerman, of the Carnegie Institution of Washington, was appointed as a consultant. With his help, and with the advice and guidance of Abel Wolman, F. ASCE, professor of sanitary engineering at Johns Hopkins University, and W. G. Hoyt, M. ASCE,

(Continued on page 61)

Interrupted-rib bolts

S. C. DICKERHOFF, JR.

High-tensile-strength bolts of interrupted-rib design were used in the erection of power-line transmission towers 398 ft high, erected for the Quebec Hydro-Electric Commission.

High-tensile bolts (A-325) of a new interrupted-rib design that provides full body bearing have been successfully used in the erection of high-tension power-line transmission towers for the Quebec Hydro-Electric Commission. More than 56,000 such bolts went into seven towers.

These river-crossing towers are part of a 300-kv double-circuit line which extends from the power site at Bersimis, P.Q., to Montreal, a distance of some 400 miles. The towers take one of these lines across the St. Lawrence River from Bout de L'Ile to Laprairie, P.Q. Five of the seven are suspension towers, 398 ft high, and two are anchor towers, 145 ft and 165 ft high. These towers were designed and fabricated by Cobra Industries, Inc., of Quebec, P.Q., and erected by the Canadian Hoosier Engineering Co., Ltd.

Standard transmission-line towers for this 300-kv line are 143 ft high, weigh 12 tons and have a maximum cross-arm width of 50 ft. This compares with a height of 398 ft, a weight of 205 tons and a cross-arm spread of 77 ft for the suspension towers used on the St. Lawrence River crossing. The distance between the anchor towers is 14,000 ft.

The erection of the two anchor towers did not create any special problems as these could be erected by a 35-ton crane with a 100-ft boom and a 30-ft jib. For the erection of the 398-ft suspension towers, however, considerable planning, special equipment and extraordinary erection methods were required. The first 100 ft of each tower was erected with the 35-ton crane having a 100-ft boom and a 30-ft jib. Because of the long unsupported lengths of bracing, this first part of the tower had to be guyed to obtain support for an 80-ft wood gin-pole and the next section of the tower. This 80-ft gin pole was used for the erection of the rest of the tower. The pole was suspended on four 5/8-in. steel-wire-rope blocks controlled from the base of the tower. The gin pole was capable of lifting a 5,000-lb load with a 20-deg angle on the wood pole.

Because of the wide base of these suspension towers, and to obtain a better lifting position, the gin pole was moved or "floated" from one side of a tower to the other by means of four winches of 6,000-lb pull located at the tower legs. A gas-motor-driven winch of 10,000-lb line pull, with a 5/8-in. wire rope and a single block, was used for hoisting the preassembled panels. For lighter pieces a 4,000-lb winch was used.

Scaffolding and slung platforms were used for the erectors to stand on while installing the bolts. Each section, made up of the panels for the four sides of the tower, was bolted in place before the gin pole was raised to hoist the next section.

As the tower narrowed with increased height, it became unnecessary to move the gin pole from side to side. Other problems developed however. With a maximum angle of 20 deg on the gin pole, the steel being hoisted had to be held clear of the outside face of the previously erected part of the tower. It was difficult to raise large sections of preassembled steel on days when high winds prevailed. For coordination of all operations, telephone communication was used between the erectors, the ground crews, and the hoisting operators.

A total of 614 heavy lifts and 25 working days were required to erect the first 398-ft suspension tower.

In the construction of power-line transmission towers, where galvanized steel is used, the slip characteristic of joints having galvanized faying surfaces has been found similar to that of painted surfaces. For such construction, body-bearing bolts are recommended because they are always in bearing. Standard high-strength structural bolts, on the other hand, depend on clamping force alone to maintain joints in alignment.

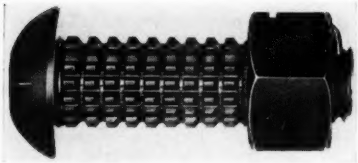
Galvanized structural steel was used in the Bersimis II—Bout de L'Ile towers. Because the joints were susceptible to slippage and because of the height

advantageous for towers

President, Automatic Nut Co., Lebanon, Pa.

of the towers, the designer sought a high-strength structural bearing bolt-and-nut combination in which the bolt would connect the members in full bearing but with no steel in bearing on the bolt threads. This would make it unnecessary to torque the nuts. Bolts could be installed by one man using a drive hammer and the nuts tightened by a hand wrench. On high towers, the use of pneumatic tools is undesirable because of the difficulty of getting air and equipment to the higher sections as well as the prohibitive cost of operation.

The bolts used have a flattened head for better driving. (The hammer is less



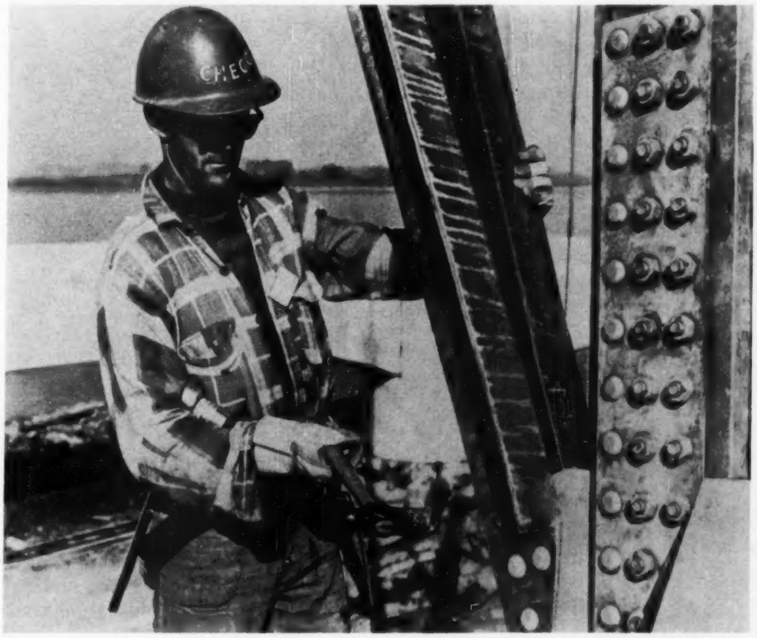
likely to slip off a flat head than a round one.) They also have a short taper at the rib ends for easy insertion into the hole. The relatively hard ribs burnish grooves in the holes of the structural members but do not peel off while being driven and do not pack material under the head. Only bolts with the proper rib length for the thickness of the plates to be joined were used so that there was no metal in bearing on the threads. Heads were slightly concave on the contact side for dispersal of stresses away from the bolt holes.

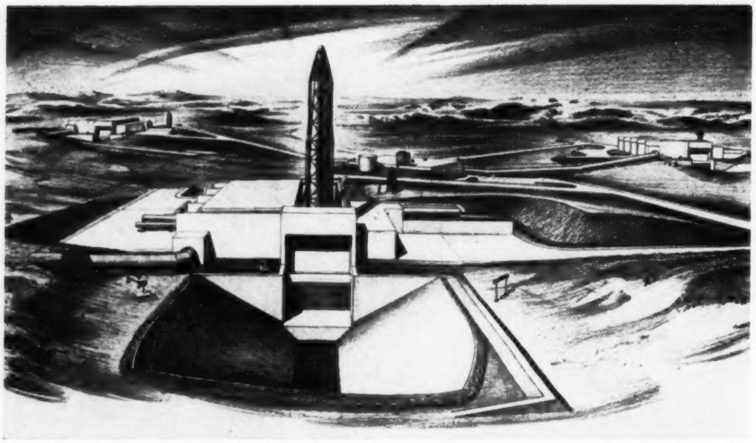
The Anco nuts used were recessed on the contact side so that when drawn up they would cover the bolt taper for a tight fit where the materials to be joined did not entirely extend over the body of the bolt. No washer was used but the nut was fitted with a self-locking pin that prevents loosening under severe stress or vibration. These nuts needed only to be wrenched to a snug fit; they did not need to be torqued and were therefore ideal for Cobra Industries' tower design and erection specifications. The bolts and nuts used were galvanized.

A series of tests, sponsored by the Automatic Nut Company, was made at the University of Wisconsin to determine the relative strength of connections made with standard A-325 bolts versus the A-325 structural interrupted-rib bolts. The tests showed that the latter bolt is considerably stronger in shear because it has greater bearing area. Interrupted-rib bolts completely fill the hole; standard bolts do not, being of smaller diameter.

Tests using A-7 metal to determine whether drive-fit bolts induce cracking in the connected material, both at room temperature and at sub-zero temperature, were conducted for the Automatic Nut Company by Lehigh University. In the sub-zero test, three assemblies of plates and bolts were immersed in a bath of dry ice and alcohol for approximately 10 minutes until their temperature was at minus 25 to 30 deg F. They were then removed and the bolts driven into the plates. Each assembly was viewed in a 220-kv radiograph. Magnaflux and X-ray examinations of the plates at room temperature showed no evidence of cracking. This test is of particular interest in cases where work must go forward in sub-zero temperatures.

Driving home a high-tensile-strength structural-rib bolt during tower erection by Canadian Hoosier Engineering Co., Ltd., of Quebec. A total of 56,620 A-325 structural-rib bolts were used in seven towers.





An artist's conception of a hardened launch complex for the ATLAS ICBM depicts preparation for flight. This complex protects the missile, personnel and support equipment against nuclear blasts.

CONSTRUCTION FOR

NORMAN N. STOUT, M. ASCE

Captain, U.S. Air Force

Project Engineer, Atlas

Air Force Ballistic Missile Division

Inglewood, Calif.

Titan Intercontinental Ballistic Missile is 90 ft high, weighs 110 tons, and travels at least 6,300 miles at 15,000 mph.

MUCH of the engineering at missile bases is done by "civils." They do not normally make the missile or press the button to send it on its way. But they develop materials and design the structure that will take the reaction from an explosion with a million-pound thrust; they design and construct the silos 160 ft deep and other structures in which the "birds" are stored and from which they are launched; they provide utilities, including great quantities of water for flame quenching. The civil engineer has a new and expanding place in the space age.—Editor.

The Air Force Ballistic Missile Division (AFBMD), under the highest national priority, directs the research and development of Air Force Ballistic missile weapons systems. The Division also conducts certain military and scientific space programs in cooperation with the Defense Department's Advanced Research Projects Agency, and the National Aeronautics and Space Administration (NASA).

The AFBMD manages the largest development program in military history. The direction of the complex program is effected through a four-way partnership. The AFBMD has immedi-

Unitary surface-type blockhouse serves as control room and shelter for personnel during launching. A corrugated pipe with blast-proof doors (later covered) connects with the launcher.

Gunite was used to form temporary walls of silo for missile housing. As excavation proceeded, gunite was applied. Here an adjacent excavation exposes the silo wall.

MISSILE LAUNCHING

ate control and supervision during research and development stages; the Ballistic Missile Center of the Air Materiel Command provides procurement and production services and logistics planning; the SAC-MIKE office of the Strategic Air Command paves the way for operational use of the missiles; the Space Technology Laboratories comprise the non-military element, furnishing systems engineering and technical direction for the ballistic missile programs. Some thirty associated contractors, hundreds of sub-contractors, and thousands of suppliers are engaged in producing the missile hardware and the extensive ground support equipment.

Vandenberg Air Force Base, California, under the Strategic Air Command, was selected as the nation's first training and operational base. It was a training base for armored divisions in World War II, and a staging area for processing troops for overseas duty during the Korean conflict.

Vandenberg consists of 65,700 acres of the original Camp Cooke Military Reservation. Soil in the area is primarily sand and clay. Upon selection of the Vandenberg Air Force Base (formerly Camp Cooke) site as the first major Air Force missile base, an extensive program of construction was initiated which, to date, has cost over 100 million dollars. This use necessitated immediate design and construction of housing and other support-type projects for military and civilian personnel required to operate the facility. During the period from October 1957 to the spring of 1958, 880 Capehart units of family housing quarters were constructed. These are all single units with three or four bedrooms and two baths. From June 1958 to June 1959, 525 additional units were constructed. Both projects were designed by Hugh Gibbs, architect of Long Beach, Calif. The first 880 units were constructed by the George A. Fuller Construction Company of New York, and handled by its Los Angeles office. The final 525 units were constructed by Dell E. Webb Construction Company of Phoenix, Ariz.

This accelerated boom in construction imposed many problems of housing expansion in two of the largest nearby communities, Santa Maria and Lompoc, to accommodate and support the many thousands of construction personnel brought there by this military necessity.

The primary mission of the Strategic Air Command at Vandenberg Air Force Base is to train military personnel in the skills required to operate the vast family of operational missiles that are now part of the Air Force weapons system.

To meet the time table of the space era, the Air Force Ballistic Missile Division, by direction of the Department of Defense, was given responsibility for the design of all the missile launching facilities. Construction responsibility for this enterprise was delegated to the U.S. Army Corps of Engineers. To accomplish this task in the shortest time and the most economical way, several of the nation's best qualified architect-engineers were selected for the design of the projects. Listed are some of the architect-engineer firms participating in design projects at Vandenberg:

Holmes & Narver
Daniel, Mann, Johnson & Mendenhall
Ralph M. Parsons Company
Tuttle Engineering
G. W. Galloway
J. H. Pomeroy
Hugh Gibbs
Aerojet General
Weston, Becket & Associates
H. K. Ferguson
Bechtel Corporation

Atlas is the free world's first intercontinental ballistic missile (ICBM). It

is liquid fueled for $1\frac{1}{2}$ stages, and powered by three rocket engines with a thrust of about 360,000 lb. It stands 82.5 ft high, weighs 250,000 lb at launching, and will carry a nuclear warhead 6,325 statute miles at 15,000 mph. It is built by the Convair Division of General Dynamics Corp.

Atlas facilities

The first launching facilities were designed by Holmes & Narver of Los Angeles, Calif., starting in October 1957. These consisted of three gantry-crane towers supported by a concrete structure resting on 30- to 60-ft piling. In addition, there is a control center in a protective "blockhouse" that houses operating personnel; a guidance facility to house the radio-inertial guidance equipment; a power plant, consisting of six 1,000-kw units; and a pump house containing three pump units to supply water at a rate of 18,000 gpm at 125 psi to spray through and protect the steel flame-deflector buckets at the launchers.

Design time was limited to seven months; construction was accomplished in 18 months. Following immediately on construction, the missile hardware and the components necessary to fire the missile were installed by Convair and the firm's associates. The design and construction within a two-year period were consummated by the successful firing of an Atlas missile in September 1959 by a SAC missile crew.

Launcher complex

In this same general area, the first coffin-type launcher was located and subsequently designed by Holmes and Narver. This complex consisted of three launchers, a blockhouse, and a guidance building. Utility support was obtained from the power plant for the adjacent missile facilities. Each launcher required about 3,300 cu yd of concrete with a half million pounds of reinforcing steel. It rests on piles driven 30 to 60 ft to a hard layer of shale and clay.

Overlying the shale, where the blockhouse is located, is a perched water table. To insure a damp-proof structure where critical temperature and humidity control must be maintained, a tile field drain was constructed beneath the floor slab. The tile field drain was brought to the surface some distance away, thus providing continuous drainage regardless of the level of the water table.

A major breakthrough in rocketry was the design of a dry flame deflector capable of resisting 360,000 lb of thrust and the tremendous heat generated, without requiring millions of gallons of water for cooling purposes. On previous installations, water was forced through nozzles in the bottom of a curved flame bucket to protect the steel from the intense heat and deflect the flame and water away from the structure. This was done by applying 12 in. of gunite to form a streamlined shape bucket resting on the structural concrete. Minor repair is required after each use to replace spalled concrete, but this is done cheaply and quickly.

Reinforced concrete blockhouses

Blockhouses, from which the personnel operate and fire the missiles, are designed to withstand the heat and blast pressure and any pressure resulting from an accidental explosion of a missile. More than 25,000 gal of rocket propellant fuel and liquid oxygen are used; the instantaneous burning action constitutes a tremendous explosion. Blockhouses usually are between 400 and 500 ft from the launcher.

Blockhouses vary in size depending on the activity, but they usually contain 600 to 1,000 sq ft and have two floors. The basement contains the power plant, air-conditioning equipment, and electronic interface cabinets. The second floor is occupied by launch and checkout consoles with their associated electronic control cabinets. The shell of the building is entirely of reinforced concrete. The roof is supported by either interior concrete walls or columns—spiral or hooped and reinforced with longitudinal bars and spirally wound steel. The roof-slab design is based on a four-way system where the reinforcement extends both directly and diagonally between columns in both directions. Walls are about 12 in. thick, and the roof, between 8 and 10 in. thick.

An additional Atlas launch facility was designed by Bechtel Corporation of San Francisco, in a new unitary concept; that is, nine units, each consisting of one launcher and one small blockhouse near it, are located over a large area to constitute a missile squadron. Design and construction time is about 15 months. The facility requires about 2,700 cu yd of concrete and 400,000 lb of reinforcing steel, including a mat or spread-type footing. This unique construction is being done by Paul Hardeman Company of Los Angeles, Calif., for about $3,000,000.

To support the missile research and development program, Holmes & Narver designed a similar launch facility where the Air Force scientific and development groups can test the Atlas missiles through live launchings under the same operating conditions used by the military personnel.

The design time allowed was less than five months, and the construction time nine months. Within two years a facility was designed and constructed, missile equipment or hardware was installed and a missile fired.

Thor facilities

The Thor is an intermediate-range ballistic missile, liquid fueled, with a single rocket engine. It will deliver a nuclear payload 1,725 miles at 10,000 mph, and was developed by Douglas Aircraft Company.

A Thor launching pad consists of a concrete mat and foundation capable of withstanding a blast pressure of 160,000 lb plus the high temperature of the exhaust gases. To deflect this heat and engine thrust, a steel flame bucket supported by structural concrete is used to route the gases into a gunite-lined channel to a disposal area. Concrete is used exclusively because it is compatible with liquid oxygen.

The environmental shelter for the Thor missile is an aluminum structure that slides back on tracks to permit the erection mechanism to place the missile in the upright position for firing. Several such launching pads are served by one concrete blockhouse capable of resisting the blast pressure or an accidental explosion. In addition to these facilities, concrete foundations are required to support the fuel vessels and a small structure for air-conditioning and electronic equipment.

These facilities were designed by Daniel, Mann, Johnson & Mendenhall. The construction cost of the Thor facilities built at Vandenberg to date is about $6,000,000, including several launching pads and the network of roads and utilities required to support the facilities.

Within this area, erosion caused by continually drifting sands presented an interesting engineering challenge. With high winds from the sea, the sand drifts somewhat like snow in a Mid-West blizzard. Limited success has been achieved by stabilizing the critical areas with shale and planting vegetation of a type called ice plants.

At Vandenberg, the Strategic Air Command has trained U.S. Air Force personnel and British Royal Air Force crews, who are now using the missiles. In addition, Discoverer satellites, boosted by a Thor Able missile, have been orbited into space. An outstanding achievement in engineering design, based on theory, was acclaimed when an accidental explosion of a Thor missile on the pad resulted in negligible damage to the brick and mortar structure supporting the missile.

Titan facilities

The Titan, the second "heavy" intercontinental ballistic missile, is liquid-fueled and two-stage. It stands 90 ft

high, weight 110 tons at launching, and will carry a nuclear warhead 6,325 statute miles at 15,000 mph. This missile, a Martin Company product, will be positioned in underground "silos."

The Titan is designed to be stored in hard (environmental protection) underground launch sites protected against enemy attack. The facility at Vandenberg Air Force Base was planned by Daniel, Mann, Johnson, Mendenhall & Associates of Los Angeles, Calif. The primary objective of using a silo to house the missile is to prevent its destruction by enemy attack, whether this takes the form of a surface bomb burst or a ground explosion.

The missile is fully loaded while in the hole, giving it a total weight of 110 tons. In preparation for firing, it is elevated to the surface. Adjacent to the main silo are additional silos housing the propellant fuels, electronic gear, operations building and power plant. All these are connected by a system of tunnels protected by blast doors.

The main silo, 160 ft deep and 40 ft in diameter, was dug and lined in about 45 days. This was accomplished by digging clay and loose shale with air spades, then loading the material into a dump-truck box by a miniature front-end loader and elevating it to the surface by a crane for disposal.

A unique technique has been utilized in constructing the temporary walls of the silo. As the hole is dug, the circular walls are lined with ring steel at about 5 ft on centers. Between the steel is placed wire mesh of hog-fence type, and the entire area is then sprayed with gunite. As excavation progresses, successive additions of gunite protect against caving.

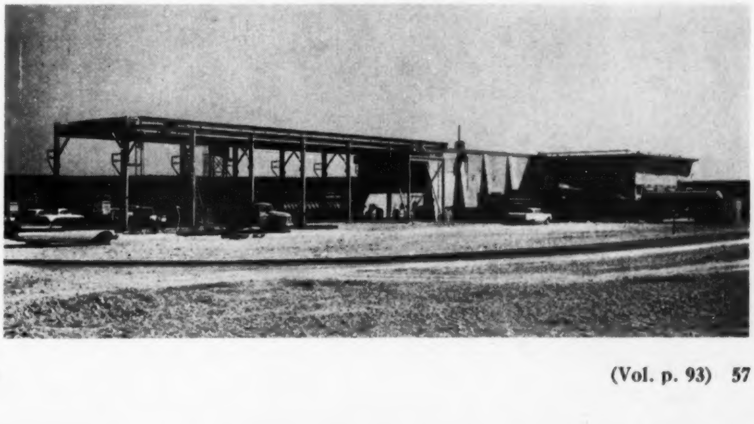
To maintain the position the United States now holds in the space era, construction ideas must be augmented to keep pace with the technological development of missiles and with the space program, which is nebulous and ever-changing. All completion dates for launching facilities must be maintained. Everything is coordinated toward a definite date, which is part of a master plan. While the missile and its controls are being designed, the launching facility is planned. When the missile and its hardware enter the nation's industrial production lines, launching facilities are placed under construction.

This time table of simultaneous development and construction often leads to changes in both the launch complexes and the missile components. The result is more work to be done but no extension of the time limit. American engineers and construction men are again at work, and with this team our nation's future in space is assured.

Construction of outer shell of Titan missile silo is nearing completion.

Multiplate tunnel between Titan launcher and control center carries power and communication ducts and permits personnel access.

Horizontal launcher at Vandenberg Air Force Base.



ASCE NEWS

One Minute, Please,

Just one minute of your time will put the ASCE fund-raising campaign for the United Engineering Center over the top. If members who have not yet made a contribution—and there are over 30,000 of them—will pledge one minute of their pay per day for this coming year and the next two, the campaign for funds can be successfully completed at once.

This is not much to ask, and it is not much to give. Just take your slide rule and make a few quick computations, using the same base to figure the time that you use to compute your salary. The benefits will be out of all proportion to the modesty of your contribution—a new home for the engineering societies of the United States. Another by no means inconsiderable benefit will be that CIVIL ENGINEERING can then report progress on construction rather than need for money.

Take a minute *now* to fill out that check and the pledge card recently mailed to you. (In case you have mislaid the pledge card, a check, made out to United Engineering Trustees, will suffice.) That minute will be an important one to the engineering profession and to your future.

Down the Stretch

The ASCE campaign for its share of the UEC funds is actually on the home stretch, with $701,827 (88 percent) of its allotted $800,000 share either in pocket or pledged as of January 8. The electrical engineers are still ahead of ASCE with 90 percent of their quota subscribed, and the mechanical and mining engineers are still trailing with 80 and 69 percent of their quotas raised. The American Institute of Chemical Engineers, the fifth Founder Society, met its quota months ago.

Zone I is the first to meet its quota, and Zone II looks as though it will be next. District 8 has joined Districts 1, 4, and 9 in meeting their quotas, and Districts 2, 3 and 6 are also nearing the 100 percent mark.

Latest additions to the Local Section Honor Roll are the Nebraska and Illinois Sections, which bring the total to thirty-three. Of the remaining Sections, twenty-two are less than $2,000 from their goals, and eight are within $800 of it. Way out in front is the Southern Idaho Section which, at 184 percent, has almost doubled its quota. The work that has been done in the Sections is a tribute to the initiative, energy, and loyalty of the many members who have been laboring for over two years to put the financing campaign across.

Typical of such devoted members is Frederick S. Snow, of London, England, who was cited as an "inspiration" by Executive Secretary Wisely in his biweekly letter to fund-raising personnel. Entirely on his own initiative, Mr. Snow has been organizing and conducting a successful campaign among ASCE members in Great Britain.

Engineering Societies Building

The present Engineering Societies Building, Andrew Carnegie's generous and impressive gift to the engineering profession at the turn of the century, is no longer comfortable or adequate for the staffs of the Founder Societies that cooperated in its building. In a half century, organizations like the engineering societies flourish and grow, while the buildings that house them become obsolescent. In the past half century, the engineering societies occupying the building have quadrupled their membership.

Worse than being obsolescent, the Engineering Societies Building is literally bursting at the seams, since it is forced to house several times the number of employees it was designed to accommodate. Crowding is the order of the day throughout the building. The accompanying photos show the cramped working quarters in the ASCE Technical Publications offices. The crowding in these offices, however, is no worse than in many other ASCE offices,

Typical of crowded working conditions at Society headquarters are these views of Technical Publications offices. In view at left four editorial assistants share a 12 by 12-ft office.

Three secretaries try to work in the cramped area at the right. With phones ringing, typewriters and dictaphones going, a high degree of concentration is required to work.

for the United Engineering Center

which might equally well have been shown. For instance, a combination lunchroom and restroom without windows or ventilation has been created out of a former storeroom.

United Engineering Center

By mid-1961 the staffs of some fifteen engineering societies plan (and hope) to be working in the new United Engineering Center, which is being built on United Nations Plaza. The new building—an eighteen-story tower of glass, metal, and limestone, rising from a two-story base—will provide 179,885 sq ft of working space, almost twice the room available in the present headquarters building.

Groundbreaking for the UEC took place in October, and work on the foundations is now underway. Construction views will be shown in CIVIL ENGINEERING as the work progresses. All that is needed now is that *one minute of your time* and *one minute of your pay for each day of the next three years.*

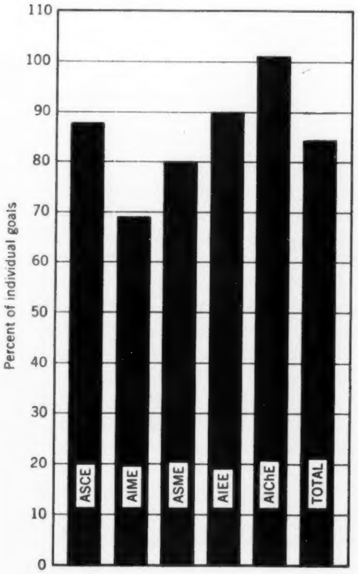


Fig. 1. Member giving for United Engineering Center as of January 8 shows that ASCE has attained 88 percent of its goal.

Campaign in ASCE Sections

Local Section	Quota %	Local Section	Quota %
The Champs!			
Southern Idaho	184	Delaware	108
Philadelphia	152	Georgia	107
Cincinnati	141	Maryland	107
Indiana	139	Central Illinois	106
Lehigh Valley	136	Connecticut	106
Columbia	132	Tenn. Valley	106
Hawaii	127	Wisconsin	106
West Virginia	124	Central Ohio	103
Kentucky	123	Nashville	103
Rochester	123	Syracuse	103
Ithaca	121	Nebraska	102
Kansas City	115	Illinois	101
Puerto Rico	115	Maine	101
Tri-City	113	Alaska	100
Metropolitan	110	Rhode Island	100
Arizona	109	Iowa	100
Central Pa.	109		
Down the Stretch			
San Francisco	98	Seattle	76
Virginia	97	Cleveland	75
Tacoma	91	Panama	75
Massachusetts	86	St. Louis	75
Texas	83	Mid-Missouri	72
Spokane	80	Mohawk-Hudson	72
Oklahoma	78	Intermountain	71
Sacramento	77	Kansas	71
Pittsburgh	76		
Gaining Speed			
Buffalo	69	Montana	61
Duluth	68	Toledo	59
North Carolina	68	Los Angeles	56
Dayton	65	National Capital	55
Akron	64	South Carolina	55
Mid-South	61		
First Gear			
San Diego	53	Alabama	45
Venezuelan	53	Michigan	45
Miami	52	Mexico	43
Wyoming	52	Northwestern	43
Oregon	50	Louisiana	42
New Mexico	46	Colorado	40
Slow Start, Strong Finish?			
New Hampshire	35	Brazil	14
Florida	33	Rep. Colombia	10
South Dakota	31		

UEC HONOR ROLL

The UEC Honor Roll grows, and now (January 8) it carries thirty-three Local Sections, listed here in the order of meeting their quotas. Newcomers to the list since we last went to press are the Nebraska and Illinois Sections. Thirty other Sections need to collect only a few more dollars to achieve their goals.

Kentucky (123)
Lehigh Valley (136)
Nashville (103)
Cincinnati (141)
Columbia (132)
Philadelphia (152)
Hawaii (127)
Rochester (123)
Ithaca (121)
Southern Idaho (184)
Indiana (139)
Delaware (108)
Kansas City (115)
Central Pennsylvania (109)
Arizona (109)
West Virginia (124)
Central Ohio (103)
Tri-City (113)
Puerto Rico (115)
Wisconsin (106)
Georgia (107)
Maryland (107)
Tennessee Valley (106)
Metropolitan (110)
Connecticut (106)
Maine (101)
Rhode Island (100)
Alaska (100)
Central Illinois (106)
Syracuse (103)
Illinois (101)
Nebraska (102)
Iowa (100)

New Group Life Insurance Plan for Members

A new group life insurance plan for ASCE members—approved by the Board of Direction on October 19 (November issue, page 77)—is available on a voluntary basis to eligible members who are not residents of Ohio, Texas, or Wisconsin. Special arrangements are being made to secure similar coverage for members in these three states. The plan will be of special value to younger members, to whom it offers exceptional coverage at low rates. The plan is the culmination of over a year of study and research.

The New York Life Insurance Company was selected as the insurer after a careful study of a number of companies. The basis of selection was a competitively favorable position in expense of operation. This is important to participants in the plan as money remaining from contributions after payment of claims and expense of operation will be available as a dividend and will be used either to reduce individual contributions or to increase insurance benefits.

The ASCE Life Insurance Plan consists of term life insurance offering an amount of protection determined by the attained age of the member at the time of death. The initial amount of insurance will depend upon the insured's attained age at his last birthday immediately prior to the effective date. Thereafter, the amount of insurance will be reduced on each birthday, as indicated in the following Schedule of Insurance.

Junior Plan—For eligible members up to and including age 30 (quarterly contribution of $12.50):

Age	Amount of Life Insurance
25 or less	$15,750
26	15,120
27	14,490
28	13,860
29	13,230
*30	12,600

* Insurance in the amount of $12,600 will be continued until the premium-due date which coincides with or next follows the birthday on which the insured attains age 31. Insurance will then automatically increase without evidence of insurability (according to the schedule of benefits for the Basic Plan) upon payment of the contribution for ages 31 to 71.

Basic Plan—For eligible members age 31 up to and including age 70 (quarterly contribution of $25), the partial schedule is shown here for five-year intervals.

Age	Amount of Life Insurance
31	$24,120
35	19,800
40	14,400
45	10,350
50	7,200
55	4,950
60	3,150
65	2,250
70	1,350
*71	Zero

* Terminal Age. However, insurance in the amount of $1,350 will be continued until the premium-due date which coincides with or would otherwise immediately follow the birthday on which the insured attains the terminal age. The Plan provides for conversion to an ordinary life insurance policy of equal amount without evidence of insurability upon reaching the terminal age of 71.

The plan was designed by the New York Life Insurance Company with the cooperation of Smith, Sternau Company, Inc., whose key personnel administer the existing disability insurance program approved for Society members. It is believed the addition of life insurance coverage to the program will fill a long-recognized need.

The life insurance plan will be administered by Smith, Sternau Company, Inc., and a trust company will act as trustee. The compensation of the trustee and the expenses of the administrator will be paid out of the contributions of the insured members and cannot in any policy year exceed 10 percent of the contributions during that year. As the plan grows after the first years of operation, it is expected that the percentage of the contributions used for expenses will be considerably lower. This is in line with the experience of similar plans. When this time comes, any surplus from the part of the contribution allotted for expenses will also be used to reduce individual contributions or increase insurance benefits.

No income from the plan will accrue to the Society.

There will be a Charter Enrollment Period from the date of first mailing. If a sufficient number of members enroll during this period members in given age groups may become insured without regard to physical condition. In any case, once the Plan is in effect, requests for insurance will be promptly processed and coverage issued for members who offer satisfactory evidence of insurability. Requests for insurance and short form medical statements will be required.

The Plan will become effective when New York Life has received requests for insurance and initial premiums from 500 members whose evidence of insurability is satisfactory.

Transfer to Higher Grade Still a Simple Procedure

Members are reminded that less than four months remain for those who were in the Junior Member and Associate Member grades on June 6, 1959, to apply for transfer to a higher grade under the requirements existing prior to that time. Amendments to the Society's Constitution, which became effective on that date, provided a grace period of one year during which application for advancement to a higher grade could be made under the old rules.

The revised requirements for transfer are summarized in the June 1959 issue (page 87). Reprints are available on postcard request to the Executive Secretary. All applications received at ASCE headquarters after June 6, 1960, will be processed according to these revised regulations.

ASCE-WPCF Joint Sewer Manual Issued

A major addition to the ASCE series of Manuals of Engineering Practice is now available in a new volume entitled "Design and Construction of Sanitary and Storm Sewers." Identified as No. 37, this publication is the result of several years of joint effort by the Sanitary Engineering Division of ASCE and the Water Pollution Control Federation (formerly the Federation of Sewage and Industrial Wastes Associations).

The twelve-chapter sewer manual contains 283 pages, over 100 illustrations, 24 tables, and more than 100 references. As the first extended collection of information on the subject, it will make a valuable reference in an important phase of wastewater technology. Individual subjects covered include organization and administration of sewer projects, surveys and investigations, quantity of sanitary sewage and storm water, hydraulics of sewers, design of sewer systems, appurtenances and special structures, materials for sewer construction, structural requirements, construction plans and specifications, construction methods, and pumping stations.

The manual may be ordered with the coupon on page 149. The list price is $7.00 per copy. However, ASCE members may order the manual for $3.50 per copy. The price to members of the Water Pollution Control Federation is the same upon application to their organization.

Salvaged Water

(Continued from page 51)

retired hydrologic engineer with over 40 years of service with the Department of the Interior, the work of the Committee was outlined.

This work is in three phases: (1) the development of basic facts and economic assumptions; (2) projections of future demands for water for various purposes; and (3) studies of techniques for meeting the demands. The final phase will consist of analyses of the reports and material secured, culminating in the Committee's report.

Full use is being made of the abilities of the several Federal agencies. Each of the states was invited to furnish the Committee with data on water resources problems. The Geological Survey will compile basic water resource data. The Census Bureau will furnish population projections. Projections of municipal water use and pollution abatement needs are being furnished by the Public Health Service. Projections of industrial water use are divided between the Business and Defense Service Administration of the Department of Commerce and the Bureau of Mines of the Department of the Interior.

Reports have been requested from the Federal Power Commission, the American Public Power Association, the Edison Electric Institute, and the Secretary of Agriculture with respect to power development. The Corps of Engineers is making studies on navigation and flood control, with agriculture and irrigation needs being handled by the Department of Agriculture and the Bureau of Reclamation. The National Park Service and the Fish and Wildlife Service of the Department of the Interior are participating in their fields.

The Committee has entered into two contracts with private groups. One of these, with Abel Wolman and Associates, calls for the preparation of a report on waste water salvage and other possibilities for improving water supply methods. The second contract is with a group known as American Resources Associates and deals with the relationship of all new techniques to multiple-purpose water management.

What is probably the most important of the Committee studies, the overall water supply-demand relationship, is being developed by Resources of the Future, under the direction of Dr. Nathaniel Wollman, of the University of New Mexico. This will involve taking all the material received from the federal agencies, putting it in terms of estimated demands for water and then relating these demands to water supply. This is being done for each of the major river basins and regions in the United States. There are 22 such resource regions, plus Alaska and Hawaii.

Information received so far indicates that the best solution to the water supply problem is to take better care of the water resources we already have. One key fact, which should be more adequately publicized, is that water is and can be re-used, over and over again, and for many purposes. The cost of water supplies developed by techniques for re-use will be less than one-tenth of the cost of water supplies developed by some of the more exotic means, such as desalting ocean waters. Certainly one of the first points of attack should be pollution abatement.

ASCE Co-Sponsors Curricula Study Conference

Twenty-seven of the country's outstanding engineering educators and professional engineers discussed ways and means of improving undergraduate civil engineering curricula at a conference, held January 9-11 at Cooper Union's Green Engineering Camp at Ringwood, N. J. The conference was held under the sponsorship of Cooper Union, which has received a grant of $43,410 from the National Science Foundation for a civil enginering curricula study. Among the educational institutions represented were Columbia, Cornell, Dartmouth, Northwestern, Purdue, and Tulane, and the Universities of Arizona, Arkansas, California, Michigan and Texas.

Co-sponsors of the project are ASCE (through its Committee on Engineering Education) and the American Society for Engineering Education. Dr. Felix A. Wallace, M. ASCE, assistant dean of the Cooper Union School of Engineering and professor of civil engineering, is directing the curricula study project.

The three-day conference did not attempt to make specific recommendations for curricula changes. Rather it was concerned with attempts to establish a philosophy and some basic principles for the improvement of civil engineering curricula. It is hoped that specific recommendations for curricula will come out of the second planning and study conference, scheduled for February 29-March 2. This conference, with the same participants, will be held at Camp Green.

A third general conference has been scheduled for July 6-8 at the University of Michigan. Recommendations for specific curricula will be presented at this time for discussion by civil engineering educators and practitioners. Some 150 invitations to this conference will be issued to engineering college chairmen. Other interested educators and engineers may attend the general conference at their own expense. They should get in touch with Dr. Felix Wallace, Assistant Dean, Cooper Union School of Engineering, The Cooper Union, Cooper Square, New York 3, N. Y.

EJC Program for Aiding Engineering Faculties

Engineers Joint Council will undertake a "visiting foreign scientist program in engineering" during the next six months. The aim of the program will be to broaden the scientific perspective of faculties and graduate students in engineering through the interchange of scientific knowledge and research concepts with prominent foreign scientists. The program is made possible by a grant of $25,000 from the National Science Foundation.

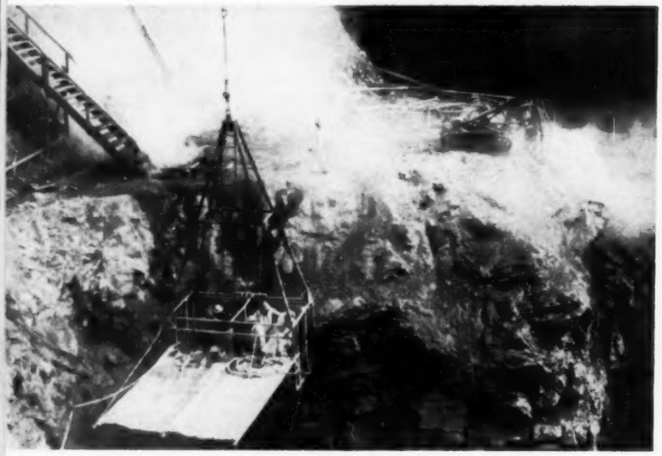
In announcing the grant and the program, EJC President Enoch R. Needles said that, "Although this program is planned primarily to aid departments of engineering with Ph.D. programs and active research activities, attention will also be given, when possible, to the needs and desires of institutions whose developing programs of teaching and research could be given strong impetus by such visits. The invited foreign scientists will also be given an opportunity to visit appropriate engineering society meetings and non-university research organizations."

The visiting scientists will be chosen by the appropriate engineering society in five specialty areas to assure that outstanding, creative, research-minded scientists are invited to participate. John S. Koss, staff assistant of Engineers Joint Council, will direct the program.

(More ASCE News on page 84)

Bolts stabilize high rock slopes

H. E. CHRISTMAN, General Superintendent, Kaiser-Raymond Company, Howard A. Hanson Dam, Green River, Wash.



Skid frame hung from crane boom serves as drilling platform for high rock bolts.

Lower bolt holes are drilled from a cage held by hydraulic powered unit.

Field forces are completing rock bolting as scheduled for the $8,800,000 Howard A. Hanson Dam on the Green River about 40 miles southeast of Seattle, Wash. This work is being done by the heavy construction forces of the prime contractor, the Kaiser-Raymond Company, using components and techniques developed on the job. The Howard A. Hanson Dam is a flood control facility being built for the Corps of Engineers. This rockfill structure, with a sand and gravel core, to be 235 ft high and 700 ft long, is scheduled for completion late in the year 1962.

On this project the high, clayey, seamy rock faces, with slopes varying to almost straight up, would not grip standard 1-in.-diameter rock bolts of the slotted-wedge type, sufficiently to meet specified torque and pull tests. To meet these requirements, larger holes, of 2½-in. diameter, were drilled for the bolts to facilitate the removal of mud and drillings from the longer holes by blowing. The longest bolt installed was 40 ft; the 1,056 bolts installed to date average 20.8 ft in length. For proper wedging action, holes were drilled for the final 5 ft with smaller, 1½-in. bits.

Bolt slots were lengthened to 10 in., the longer wedge required was developed, and gripping lugs were welded to the slotted ends of the bolts.

For different rock conditions elsewhere at the site, a second modification was made by welding to the end of each rock bolt a 4-in. length of rod of 1⅜-in. diameter. For increased holding power, weld beads were applied to the slotted 1⅜-in. rod. A large wedge was used and this modified bolt, when driven into the 1½-in. hole, provided the desired gripping action.

Ground water and air pockets made usual grouting procedures impractical. To meet this difficulty and place grout in the back of the hole near the wedge, a 2-in. pipe, 2 ft 6 in. long, was slipped over the rock bolt and a vent pipe of small diameter was run through the 2-in. pipe to the back of the hole. All air and water were thus vented completely as grout was pumped in to the full depth of the hole. Complete control of the grouting action was maintained by visual inspection of the vent pipe discharge. As the drill hole was filled, the vent pipe was withdrawn. An 8 x 8-in. plate washer was placed on a mortar bed and the nut run down onto the rock bolt. After the grout attained strength, a torque of 100 ft-lb was applied with a calibrated wrench.

The use of high-early-strength cement, with mortar sand in the grout, accelerated the set-up time and permitted pull tests to be made 24 hours after

Rock Bolting Equipment

- 2 Gardner-Denver Model 123 Air-Trac drills
- 1 slope skid with 2 CF 99 Gardner-Denver drifters
- 1 50-ton American truck crane
- 1 900-cfm Gardner-Denver diesel portable compressor
- 1 2-ton Chevrolet flat-bed truck
- 1 grout pump with Gardner-Denver air motor and grout-mixer tank
- 1 Jaeger 6-cu ft grout mixer
- 1 36-in. torque wrench
- 1 American Economobile

Grouting arrangement for bolts is seen with a vent pipe partly withdrawn.

Torque wrench was used to tension bolts up to 40 ft long to tie the rock face against sliding.

grouting of the rock bolts. All pull tests on rock bolts grouted in this manner proved satisfactory. Pull tests conducted by L. H. McGuire, Subdistrict Supervisor, U.S. Department of the Interior, Bureau of Mines, were stopped at 20,000 psi on the net section of the rods, well below the yield point of the steel.

About 65 ft of the slope on the intake channel was exposed at the time the first bolts were installed. To overcome the resulting inaccessibility, slope skids and grouting baskets were employed. Where practical, the cage was handled from a self-powered hydraulic "Economobile." Two Gardner-Denver CF-99 drifters were mounted on the slope skid, which was operated by cable and winch secured to the slope. The grouting basket, or platform, had a rear deck for hardware, rock bolts and vent pipe, and was supported from an American 50-ton crane. Most of the holes for the rock bolts were driven with a Gardner-Denver Model 123 Air-Trac, mounted on staging when required, or from benches in the excavation following completion of bolting on the initial 65 ft of exposed slope.

Storm-water control for a shopping center

A unique design is providing an answer to a perplexing storm-water problem for a large shopping center in Florissant, Mo., a suburb of St. Louis. The Grandview Plaza Shopping Center will be constructed on a 33-acre lot draining into Fountain Creek, which has a large history of flooding. The Metropolitan St. Louis Sewer District, which has completed and is now reviewing preliminary engineering plans to improve conditions on Fountain Creek, insisted that storm-water runoff from the developed area must not be greater than the rate of flow from the property in its undeveloped state—to prevent overloading of existing sewer facilities.

The developer, Shanedling and Company of Los Angeles, aided by local consultants Thatcher and Patient, evolved a suitable design which utilized a paved parking lot for the retention of storm water with a control weir at the point of discharge into the creek. The plan is geared to the maximum recorded rainfall and provides for controlled discharge at a rate no greater than that which would occur if the land had remained in an undeveloped state.

The parking lot is divided into a series of depressed rectangles. Storm-water pipes drain off water from the lowest point of each rectangle to a control system, consisting of a concrete manhole 30 ft deep with a 6-in. bleeder pipe at the bottom. See Fig. 1. During a light rainfall, the bleeder pipe discharges directly into the creek, but during heavy rains, water—under heavy hydraulic pressure—cannot get out through the bleeder pipe. It thus gushes up through the top of the manhole and passes through a specially designed V-notch weir, which then controls the discharge of overflow into the creek. Meanwhile the excess water remains on depressed parking areas until it can drain down to a control point. If the maximum anticipated rainfall were to be reached, the total depth of water on any one depressed rectangle would be about 12 in. Heavy to medium rainfall would yield a depth of 2 to 3 in.

Under the terms of the approval agreement with the Metropolitan St. Louis Sewer District, the entire system remains the property of the developer. He is responsible for all maintenance and repair and is also liable for any damages. The system is an excellent solution to the problem since the property is protected; Florissant gets a tax revenue (about \$3½ million in assessed valuation); and development is permitted on an orderly basis to satisfy the needs of an expanding community. A similar system is in use in Hollywood, Calif., and the same method was used in principle at St. Louis's Lambert Field to handle runoff from runways.

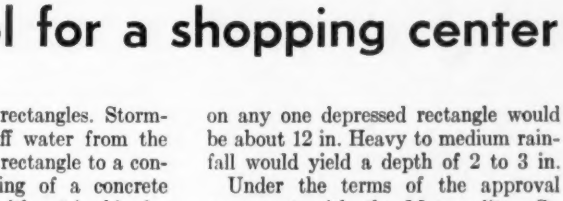


FIG. 1. Method of controlling storm water for Grandview Plaza Shopping Center is seen in schematic diagram.

Wet rotary pre-excavation for piles

LINDSEY J. PHARES, F. ASCE, Vice-President, Raymond Concrete Pile Company

Division of Raymond International Inc., New York, N. Y.

Piles for Detroit's new Convention Arena are being driven in clay soil. World's tallest pile driver, a Raymond crawler rig with 194-ft leads, pre-excavates pile holes to protect the city's main interceptor sewer.

The deepest known pre-excavation of pile holes by the wet rotary process solved a difficult foundation problem on the construction of a 17-story apartment building in Boston, Mass. It protected the foundations of old adjacent buildings by eliminating the ground heave and vibration that would normally have resulted from driving displacement piles through the deep subsoil of incompressible clay at the site.

Basically, the method consisted of drilling holes slightly larger than the 14-in. pipe piles and about 130 ft deep. Water discharging through a fishtail washed cuttings to the surface, and the resulting slurry lined the walls of the hole and prevented sloughing of unstable soil layers. When a hole was completed, a pile was lowered into it slowly, displacing the slurry by forcing it to the surface. Then the pile was driven to the required resistance. Of the 139 closed-end piles driven, the longest was 210 ft.

The results were very satisfactory. Vibration tests conducted by Liberty Mutual Insurance Company showed that piles driven as close as 5 ft to an existing five-story brick building, supported on granite sills and wood piles, produced a dynamic effect "in a very safe range, and with a large factor of safety."

Pre-excavation was indicated because of the difficult soil, which was a very compact sand and gravel extending about 40 ft below the pile cutoff grade, underlain by about 150 ft of soft blue highly impermeable clay. Below that, compact sand and gravel and blue shale offering good bearing were encountered. See Fig. 1 for boring and driving data.

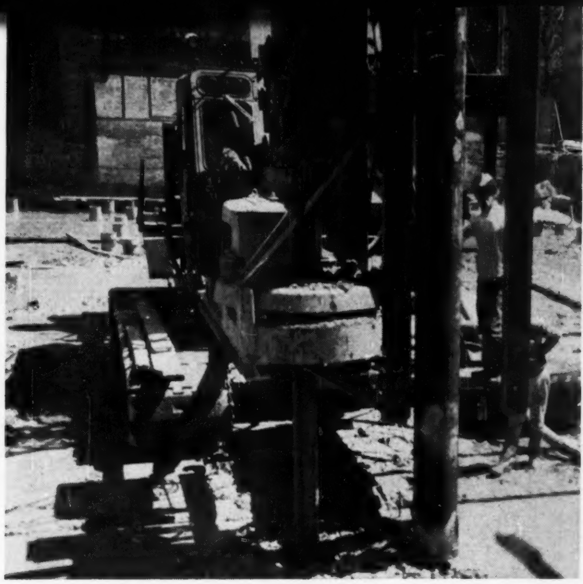
After several foundation designs had been suggested, it was decided to try the wet rotary method of pre-excavation using closed-end pipe piles. This method offered the economy of long pipe piles and the promise of eliminating displacement of the soft clay.

Wet rotary pre-excavation was carried out with a modified Raymond pile driver. Drilling equipment mounted on the sides of the pile-driver leads consisted of a powered rotary table, a guide beam extending the full height of the leads, a fishtail drilling bit, drill stem, water swivel, hose piping, mud circulation pump, and sump unit. The drill stem was at the same radius as the pile to simplify spotting of the pile after the hole was excavated.

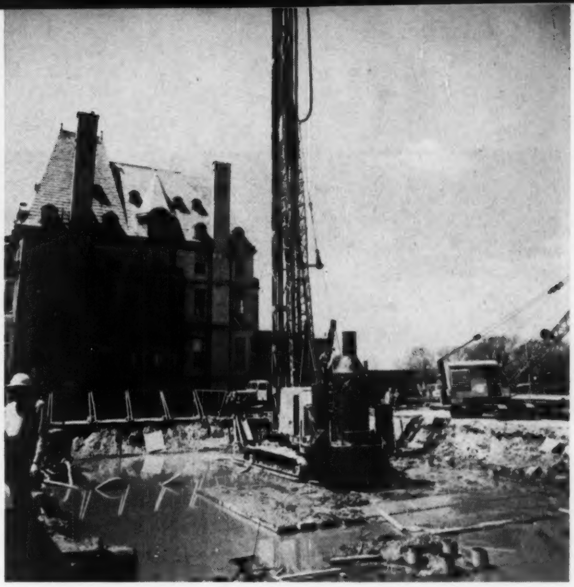
Rotary drilling started by spotting the drill bit over the pile stake. When the drill stem was plumbed, water was turned on and rotation started. Water discharged through the fishtail bit and washed cuttings to the surface. The slurry was drained to a sump and the water recirculated. Settled solids were removed from the site.

Piles were driven in clusters of three or four; clusters were about 14 ft apart in one direction and 19 ft in the other. Because of the highly corrosive soil near the surface, piles were made of two sections—a top section 60 ft long with a 0.375-in. wall, and a bottom 140-ft section with a 0.281-in. wall. Welded to the bottom of the pipe was a flat steel plate $14\frac{1}{2}$ in. in diameter by $1\frac{1}{4}$ in. thick. Sections were spliced with a long, heavy-duty drive sleeve.

The work was done with a Manitowoc



Pre-excavation machinery mounted on side of leads drills hole on Boston job. Pipe pile already in leads is easy to spot for driving because it is on same radius as drill stem.



Old building on Boston job was protected from damage by pre-excavation of pile holes, which eliminated heave and vibration from driving of piles as much as 200 ft long.

3900 crane equipped with an 80-ft boom and 136-ft leads. The hammer used was a Vulcan 80-C differential type developing 24,000 ft-lb per blow. A load of 210 tons was placed on a pile, in a test supervised by the engineering firm of Thompson & Lichtner Co., Inc. Three hours after the load was removed the pile showed a rebound to within 0.35 in. of its original position.

Raymond's development of the wet rotary pre-excavation method started some years ago to control pile driving in Detroit's tricky clay subsoil, and has since proved itself on a number of jobs in southern Michigan, Milwaukee, Houston, and overseas in Iraq.

Early double-tube pre-excavator

Before the development of wet drilling methods, Raymond sometimes used a pre-excavator of double-tube type. The outer tube was open at both ends and the inner tube was closed at the top and open at the bottom. During driving of the tubes, soil was forced into the inner tube. After the tubes had been driven the required depth, a vacuum was applied to the top of the inner tube to hold the clay inside. When the inner tube was extracted by the pile driver, the vacuum was replaced with steam pressure, and the soil plug was extruded.

The outer tube, of course, remained in the ground as a temporary casing to prevent collapse of the hole. A pile was inserted in the cased hole and driven to grade, and then the outer tube was withdrawn, combined with the inner tube, and reused.

This method worked well, but had its disadvantages. Pre-excavation could

FIG. 1. Boring and driving data are given for a typical pile for Boston apartment building where wet rotary pre-excavation was used to open the hole to depth of 140 ft. Drilling time was 12 minutes. First column gives resistance to penetration of the soil as shown by the number of blows required to drive a sampling spoon of 2-in. outside diameter one foot, using 140-lb weight falling 30 in. Second column records depth below the surface, in feet. Third column records the number of blows required by an 80-C differential-acting hammer to drive the 14-in. closed-end pile one foot.

Excavated	Penetration resistance	Depth of pile tip, ft	Blows on pile per ft
Firm coarse sand and gravel fill	(Blows on sample spoon)	1	(80-C hammer)
	12		
		5	
	10		
		10	
Soft silty sand	4		
		15	
Silt and shells			
	4		
Compact coarse sand			
		20	
	35		
Coarse gravel			
	25		
Hard medium gray sand		25	
		30	
	25		
Compact fine yellow sand			
	35		
		35	
Soft blue clay	4		
		40	
		127	4
	2	128	5
	2	149	7
		150	9
	2	165	11
		166	12
	2	186	28
		187	29
		188	30
		189	31
		190	31
Compact coarse	20/6"	191	98
sand and gravel	150/0"	192	13/16/20/in.
Total blows on pile			1065
Blows, last inch			20

Wet rotary drilled to 138 ft

Fishtail bit is basically a flat steel plate with fishtails turned in opposite directions for better cutting. Water traveling through 6-in. hollow stem is discharged in two jets, one on each side of plate.

Rotary table, electrically powered, operates drilling bit on Houston job. Slurry prevents sloughing of unstable soil layers in hole.

not be made to any required depth, and the fit of the pile in the hole was not nearly as snug as is now possible with wet drilling.

Addition to Ford Plant

One of the first applications of wet drilling was in the construction of Battery "D" of the Koppers Coke Ovens at the Rouge Plant of the Ford Motor Company in Dearborn, Mich. The foundation required the driving of a large number of piles adjacent to a discharge tunnel from the main powerhouse. The brick transition section to the tailrace, as well as a stack nearby, was particularly vulnerable to subsoil movements. Also, an adjacent electrical control room resting on a floating mat was in danger, because pile-driving vibrations and ground heave could have broken electrical circuits and interfered with plant production. Wet rotary pre-excavation was adopted for the installation of all the piles in the area, and there was no evidence of heave and no interruption to work.

Sometimes underground pipelines are just as vulnerable as buildings to displacement from pile driving. In the construction of the Henry and Edsel Ford Auditorium in Detroit, for example, a high-pressure fire-water line serving the downtown area could not be relocated off the site, so wet drilling was used to install the structure's foundation piles without disturbing the pipeline.

To break through a hard crust of earth is another purpose of pre-drilling. At a Consumers Power Company plant in Bay City, Mich., for example, 4,300 Step-Taper piles had to be driven through a very hard clay crust 15 ft thick, then through 35 ft of soft clay to rock. Wet pre-excavation was used to penetrate the crust and also to relieve the displacement and resulting pressures that would have resulted from driving piles into the soft clay confined by the crust.

A unique application of wet drilling occurred during construction of an addition to the Milwaukee City Hall. The soil consisted of an upper layer of gray clayey silt 40 ft thick, containing small stones and occasional boulders. The soil below was similar, but extremely hard and containing much more sand. Problems arose early with the upper layer, which had been subjected to a glacial-till loading of from 6 to 9 tons per sq ft. As a result, its clayey silt formation had been highly surcharged and overconsolidated so that the water content was as low as 11 to 15 percent by dry weight. When such a dense soil is disturbed, it cannot further consolidate but must expand, thus changing from a dense to a loose state.

When cast-in-place piles were driven into this soil, heave resulted, but even more important, pile resistance was largely dissipated and redriving only made matters worse. The answer was to pre-excavate by rotary methods through the upper 40 ft so that the top layer was not disturbed by pile driving. Also, longer piles were driven to obtain proper resistance in the more granular material in the lower layer.

Wet drilling on batter

Wet rotary drilling solved a unique foundation problem in the construction of a new wharf in Houston, Tex. Because of a high bank of earth along this 1,000-ft wharf on Houston's ship channel, a sheetpile retaining wall was required. Bracing was provided by about 175 prestressed concrete piles driven through stiff clay at the unusual batter of one vertical on two horizontal. These piles, which averaged 60 ft in length, were driven 6 ft apart along the sheetpile wall and battered toward the wall. They were 18 in. square, with a center void of 9-in. diameter, and were plugged at the ends. A pile of this size on a batter could have been driven only with the greatest difficulty without pre-excavation.

Raymond's method consisted of mounting a drill of 16-in. diameter on one side of a pile-driver lead. While the drill excavated the hole, water discharged through the end of the bit washed cuttings to the surface. The resulting slurry served the vital function of supporting the walls of the sharply battered hole and preventing the layers of silty sand from sloughing.

On Houston job, pre-excavation permits installation of precast concrete pile at difficult 1-to-2 batter.

Does the civil engineer need ASCE?

A recent graduate says "Yes," and the younger men need it the most

AUBREY D. MAY, A.M. ASCE

Last spring Aubrey May won the Daniel V. Terrell Award of the District 9 Council of Local Sections for the best paper on this subject by a Junior Member. He is a graduate student at the University of Kentucky, working toward his M.S. in Highway Engineering while serving as acting head of the Soils Section of the University's Materials Research Laboratory.

Today the civil engineering profession needs an organization such as ASCE. Perhaps this need was not so urgent earlier in the century but has become more meaningful with increased specialization and the growth of the profession. An internal organization is essential to any large group if it is to have any power or active purpose. History has consistently shown the need for men with common interests to join together to gain recognition.

Generally however, the civil engineer does not join ASCE for this reason, but because as an individual he stands to reap many direct benefits. Some can and do practice civil engineering without membership in ASCE, but even these people profit indirectly through the efforts of the Society. Also, I believe that our outstanding civil engineers are leading members of ASCE. No scale can be placed on the benefits to an individual member, and others might assign a different importance to them altogether. But in my opinion the young engineer stands to gain the most through ASCE.

First, ASCE provides a tie between the engineer and others in his own field. It is very important for young engineers to become acquainted with the more experienced and prominent engineers. Members of a Rotary Club, Lion's Club, Kiwanis Club or other such organization have a common aim in a sense, but only in their own professional society will civil engineers be grouped with men who have a truly common goal. ASCE provides a means whereby an engineer who has just been transferred to a new location can become acquainted with fellow engineers and can demonstrate his abilities. He can establish himself much faster through ASCE than he could alone.

Through ASCE the various groups in civil engineering are able to express their viewpoints on local and national problems, to recognize and remedy shortcomings in the profession, and to introduce new undertakings for the profession. Contractors, consultants, educators, and the various levels of governmental engineers are all represented. It is very important that these sub-groups should have an organization through which they can cooperate and strive for what is best for the profession.

Much of what I have said applies at the Local Section level, where the benefits of good communication among engineers are also important.

Through ASCE, civil engineers as a whole can work more closely at the national level with other professional engineering groups. While we have not yet been able to achieve the complete unity among the various professional engineering societies that we all know to be desirable, a great advance will have been made with the completion of the United Engineering Center in New York.

A young member can improve himself through ASCE by speaking before groups, by serving on various committees in the Society, by making contacts with the public while representing the Society, and by other activities in which he can develop abilities other than those of a technical nature.

Where it has not already been done large Local Sections should be subdivided to enable more engineers to have a more active part in the functioning of the Society. It is more convenient for members to attend meetings not too distant from their homes or places of employment. Such a system would probably increase the membership and give the Society still more strength and authority.

Another benefit the young engineer receives through ASCE membership is a means of continuing his education. In earlier days, after completing a college course or service as an apprentice, the engineer needed little or no further learning to successfully practice his calling. This is far from the case today.

If you graduated yesterday and did not learn something new today, then you will be uneducated tomorrow. I can think of no better way to keep oneself informed than through the vast quantity of literature made available through ASCE. Inspection trips also provide contact with new methods and designs.

An urgent need today is for cooperation between science and engineering to reassure a world in fear of war. Man no longer fears the physical elements but he does fear the consequences of modern inventions, experimentation in nuclear energy, and the exploration of outer space. The civil engineer bears a partial responsibility for reconciling the opposing elements of destruction on the one hand and of useful creation on the other. With the engineer, who is equipped with a knowledge of the laws of nature and the ability to put them to practical use, lies the responsibility for restoring man's faith in his own works.

The engineer enjoys the confidence of the public and should not cheapen his profession by taking refuge in mediocrity. He is much better equipped to fulfill his duties if he is supported by a strong far-reaching organization that can operate all the way up from the local level to the national level. Such an organization is ASCE.

Probably many believe that the Society has certain deficiencies and that it does not possess the authority it should have to contribute more to the economic advancement of the civil engineer. I believe ASCE is a progressive body that can develop to overcome any deficiencies. As it continues to progress, the civil engineer's need for it will grow proportionately.

Development of marginal

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There has always been reluctance among some home developers to invest or "bury" money underground where it cannot be visually appreciated by the prospective home buyer. However, the wet winter of 1955-1956 in the San Francisco area proved to all in the home development industry that a dollar saved at the expense of soil stabilization can result in catastrophic losses. Numerous slides in counties around San Francisco compelled the insurance companies to cancel all slide insurance. Such action, coupled with lawsuits involving the developer, the grading contractor, and even the engineer, has now induced many far-sighted home developers to employ engineering talent, not merely to satisfy the requirements of government agencies, but to insure themselves against serious trouble in the future.

Soil investigations and the proper development of marginal lands are becoming increasingly more important in California since that state is experiencing a phenomenal increase in population. In the San Francisco Bay area alone, thirteen counties have been especially attractive to newcomers; the rate of population increase for this area has been 340 per day for the past nine years. San Francisco and other Bay Area communities have consequently experienced a tremendous demand for new housing.

Existing residential sections have already utilized all accessible terrain and can absorb but little of the increase. Therefore the imagination of the building entrepreneur has soared to new heights in the search for new building sites. Builders have discovered that dead-end streets are not "dead," and that a few extra lots can be squeezed in—either by pushing up the slope a little farther by cutting, or by moving down the slope across a ravine by filling. Abandoned dumping grounds have been reclaimed and even old cemeteries dug up and converted into building sites. Relatively flat lands near the shores of the Pacific Ocean, although underlain by shifting sand dunes and traversed by active faults, have rapidly grown into densely populated communities.

After all the flat land had been occupied, it was natural that the builders should take to the hills. To provide the needed building lots a host of new building entrepreneurs followed the relatively simple method of filling in existing holes and shaving off existing hills. In the course of changing climatic cycles, however, and particularly after wet winters, home developers began to realize that "hills can move" and that some of the "holes" they had filled seemed to be bottomless. In many instances, homes built on these artificial lots virtually cracked up as a result of slides or disintegrating fills.

The situation called for caution in the home building industry. The first action was taken by government agencies. Soils engineering was made mandatory in the preparation of lots for residential construction using federal loan insuring agencies, and city building ordinances were strengthened. The home owner further protected himself from the "you never know" possibility of earth movement by obtaining comprehensive slide insurance.

The high cost of developing marginal land warrants the utilization of soils engineering technology and the extra cost of "doing things right" in the early stages of the work. Several real estate subdivisions located in the roughest but most desirable hillside and canyon areas of San Francisco have recently proven the value of careful engineering, planning, soil analysis, and supervision of grading operations. Two of the completed subdivisions with which the writer has been connected illustrate the exploratory methods and the soils engineering principles employed and show that man-made fills and cuts can be built to stay.

West Twin Peaks development, known as Midtown Terrace, is in an amphitheater-like valley. The upper part of the development occupies a cut-and-fill bench directly below the peaks.

The general rules of investigational procedure applied to these subdivisions apply to any hillside subdivision on difficult terrain. They can be outlined as follows:

1. A preliminary field study was made of the local geology. All salient features were noted, such as exposed rock outcroppings, abrupt irregularities in topography, old slide areas, growth of hydrophytic vegetation, and the natural drainage lines. All observations made in the field were marked on the grading map, which also showed existing and proposed contours.

2. The drilling program was planned in the light of this information, test borings being located in irregular topographic areas such as ravines, humps, or hummocky slopes characterized by

lands in San Francisco

the growth of suspicious vegetation. Power drilling equipment was used and access for equipment was prepared by bulldozers, following hill contours. Where rock changed abruptly to alluvium, as in ravines or on old terraces, test borings were carried to rock. Test borings were made in all proposed major cut-and-fill areas to detect underlying weak zones. All test borings were located on the proposed grading map, and ground-surface elevations were obtained.

3. Supervision of test borings and sampling of penetrated soils was carried out by qualified soils engineers with a sound geological background.

4. The laboratory test program was then planned, after careful examination of test-boring logs and the undisturbed and disturbed samples taken from the test holes.

5. A technical analysis was made of the field observations and laboratory test results with a view to determining the feasibility of the proposed grading program, and a report embodying all findings and recommendations was prepared.

6. Supervision of all grading operations and remedial soil stabilization work was carried out on a full-time basis by a soils engineer.

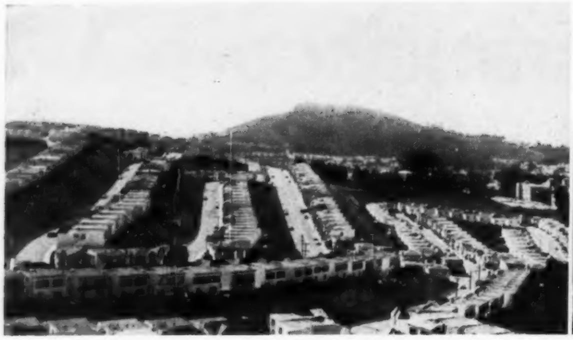
West Twin Peaks subdivision

Twin Peaks is the high point of a hilly ridge in the geographic center of San Francisco and on the projection of the main thoroughfare of the city. The elevation is about 925 ft above sea level, making it the highest point in San Francisco. The topography is rugged and geological formations vary, the older sedimentary beds being intruded by igneous rock and blanketed with ancient alluvial terraces.

The West Twin Peaks Development consists of six subdivision units comprising 16 streets and 734 lots, and is known as Midtown Terrace. It is located in the amphitheater-like valley on the west slope of Twin Peaks. Elevations range from 840 ft at Twin Peaks Boulevard to 435 ft at Clarendon Avenue. The upper part of Midtown Terrace occupies a cut-and-fill

Population increases in the San Francisco area have resulted in the development of marginal lands such as West Twin Peaks. The utilization of soils engineering technology resulted in safe, stable conditions for the housing development in foreground.

An ill-fated attempt to fill part of a ravine in Mira Loma Park in 1942 resulted in failure of the fill. Sliding down as a mud flow, the fill buried two houses in its course, with the result that one woman was killed and another permanently injured.



At the West Twin Peaks Development grading has modified the natural slopes by means of cuts and fills to form several terraces. Each terrace supports a street and a single tier of lots, except for the two lowest streets, graded for double-tier lots.

Another development, called Mira Loma Park on the south slope of Mount Davidson, is seen after completion of grading. The same soil investigation procedure was followed as for the West Twin Peaks development, seen at left.

bench directly below Twin Peaks Boulevard.

The natural overall slope of the area was approximately 1 vertical on 3.3 horizontal. The slope was traversed by deep ravines which served as natural drainage channels discharging into a storm sewer in Clarendon Avenue.

Soil explorations revealed the existence of several bedrock ravines which had been buried by modern wind-blown sand and ancient alluvial terrace materials known locally as the Merced formation. The latter includes fine-textured soils with lenses of coarse water-bearing material and is often underlain by stiff organic marine mud. The bedrock consists chiefly of thin-bedded chert ("red rock") and weakly cemented arkosic sandstone with extensive intrusions of basalt and serpentinized peridotite. All rocks are weathered, broken, and partly decomposed, and areas of thermo-chemical alteration occur in the vicinity of igneous intrusions.

Active and potential slide areas were encountered within the subdivision as well as strong springs in areas of proposed cuts and fills. Grading plans provided for modification of the natural slopes by cuts and fills to form seven terraces, each terrace to support a street and a single tier of lots, except for the lowest two streets, which were to be graded for double tier lots. The deepest cut was about 60 ft and the highest fill about 100 ft, measured vertically. Both cut and fill slopes were made 1 vertical on $1\frac{1}{2}$ horizontal.

The significant features of soil stabilization in the development of Midtown Terrace can be summarized as follows:

1. A deep, active ravine was filled. A controlling feature of the topography was a deep active ravine which was to receive a fill approximately 100 ft deep. A longitudinal profile along the thread of the ravine, with final grade and stabilization features, is given in Fig. 1. Before the fill was placed, the bottom of the ravine was excavated to the underlying bedrock, which in some places involved an excavation 20 ft deep. Excavations at least 5 ft deep into bedrock were made at intervals in the bottom of the ravine and up on the shoulders on both sides to provide shear keys and shoulder drains beneath the fill.

A subdrain was then placed in the bottom of the ravine. The thickness of the drain rock blanket varied from 6 to 12 ft where seepage was encountered during grading operations. On the shoulders of the ravine, lateral rock drains were installed and connected to the main drain. Discharge from the main drain after completion of grading varied from 6 gal per min in summer to as high as 20 gal per min in winter. Select fill was placed under the supervision of a soils engineer and compaction requirements called for 90 percent of the Modified AASHO specification. In the shear keys and their immediate vicinity, 95 percent of the Modified AASHO was required.

2. An old slide area was stabilized. The head of the ravine had been undergoing occasional earth movement, as was evidenced by the presence of a hump at the lower and flatter part of the ravine and a corresponding drop at the head of the ravine. Many active springs were also present and the unstable slope was traversed by tiny rivulets. Test borings sunk at various points on the saturated slope revealed the presence of an ancient slip zone which consisted of a bluish-gray, putty-like clay, about 8 in. thick and making an angle of about 12 deg with the horizontal. The depth from ground surface to the slip zone varied from 12 ft at the top to approximately 20 ft at the toe of the slide. The material overlying the slip zone and the putty-like bluish-gray clay were excavated. The underlying slope surface thus exposed was found to be spotted with springs.

It was suspected that a reservoir, directly above the head of the ravine, was leaking and that the source of the water, or at least a part of it, was from this reservoir, but no proof of this could be established. At any rate, no matter what the source of the water, approximately 40 ft of fill was to be placed on the slope to provide building lots for the planned subdivision. It was not economical to intercept the seepage by a deep intercepting ditch or by deep drainage wells. As an alternative, a system of parallel intercepting ditches were excavated, such that the bottom of each upper ditch would be lower than the top of the parallel ditch below. These ditches were provided with drain tile and drain rock and were connected to a manifold which led to the street sewer. The discharge from this system has varied from a low of 4 gal per min in summer to 40 gal per min in winter.

The fill material was then placed and compacted on top of the drained slope. It was keyed into the natural soil by benching between the parallel drains.

3. Cuts across buried ravines were stabilized. On completion of the cuts on the upper side of a terrace, it was noticed that several buried sand V's were exposed in the predominating rock formations. The character of the sand varied from silty and clayey to uniform clean medium sand. The cut face, however, soon began to slough and in deep cuts (exceeding 60 ft in vertical depth) the toe of the cut showed signs of imminent failure. Since houses were to be built both above and below the cut, the stability of the slopes had to be such as to ensure the safety of the houses and avoid nuisance from sloughing.

Hydrauger holes were tried but very few of them intercepted water pockets. Test borings showed that the seepage was confined to the clean sand stringers which were embedded in the silty and clayey sand body. To intercept this water, deep wells of large diameter were drilled by a bucket rig back of the top of the cut to penetrate the toe of the cut or extend below it. The behavior of each well was observed during drilling, and wells that penetrated a water-bearing stringer were filled with gravel. Dry holes were backfilled with soil. The wet wells were then tapped at the toe of the cut by means of hydrauger holes and pipes so that each pipe was a "wet pipe." The discharge from these pipes has been fairly steady through all seasons of the year.

The greater part of Midtown Terrace was completed in 1956 and has successfully withstood the "weather test" of several wet winters, including the very heavy precipitation during the winter of 1957-1958. It has also withstood the sharp quake of April 24, 1957, which had an intensity of 6.25 on the Richter scale.

Mira Loma Park

Mira Loma Park subdivision is on the south slope of Mount Davidson, which lies southwest of Twin Peaks at an elevation of 900 ft. The subdivision comprises approximately 17 acres and has been graded to accommodate 8 streets and 154 lots. The highest point is at El. 760 and the lowest at El. 400.

Before development, this site had been used as a rock quarry above El. 600. Below that elevation it was traversed by deep ravines and water draws. Among local developers the site was considered hazardous because of an ill-fated attempt early in 1942 to fill a part of a ravine below El. 600. The fill failed, sliding down as a mud flow to a street below and burying two houses in its course. The present developer, fully aware of the hazard, willingly gave the soils engineer a free hand in stabilizing the proposed fills and cuts.

The same procedure of soil investigation was followed as for the West Twin Peaks development. Test borings and a study of local geology revealed the existence of buried soft clay layers at an appreciable depth below the ground surface on which the fill was to be placed. These soft clay layers, varying in thickness from several inches to several feet, lay approximately parallel to the sloping ground surface, which in some places was inclined at an angle of about 27 deg. Test borings also revealed wide and relatively deep water draws which had been cut into the rock and later buried under alluvial

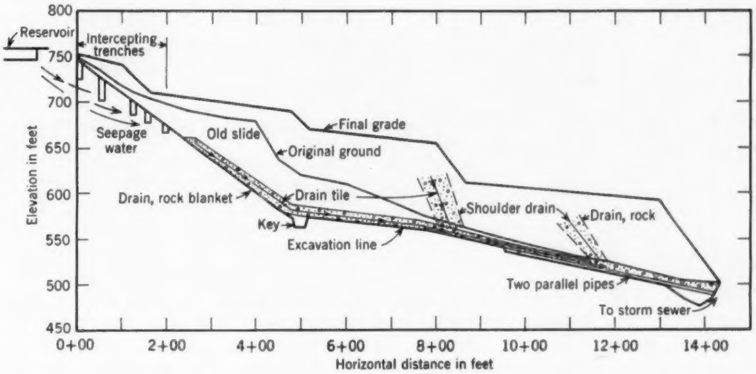


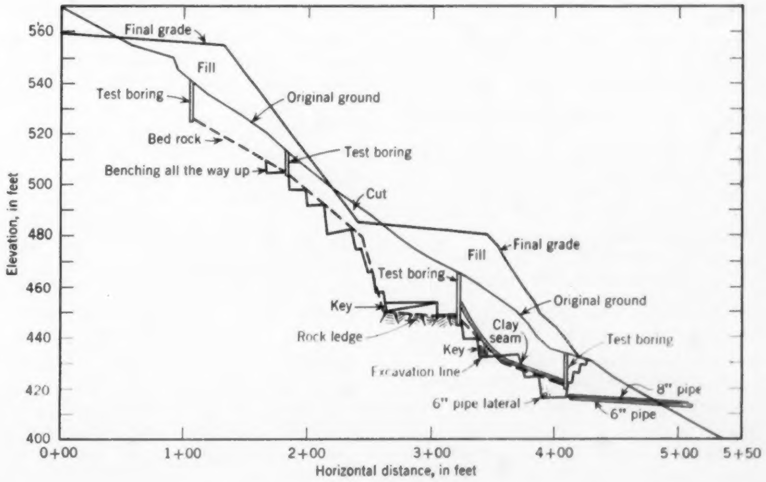
FIG. 1. Longitudinal profile along the thread of a ravine in the West Twin Peaks development shows final grade and stabilization features.

debris from the hills above. Several layers of soft clay were found at various depths in this alluvium, and water issued under pressure from beneath the clay layers.

It was considered necessary to remove and stockpile all the alluvial overburden and the underlying soft clay before placing the fill. This necessitated deep excavation; in some instances, cuts 30 ft deep had to be made and backfilled before 20 ft of fill above the original ground surface could be safely placed. The removal of the slippery material and the installation of subdrains to intercept the water and to prevent it from entering the fill were necessary not only to provide safe foundations for the fill but also to strengthen natural soils further down the slope where the seepage water appeared at the surface and supported luxuriant wire grass. A typical design section through the lower part of the subdivision below El. 600 is given in Fig. 2.

When proposed fills were shallow it was deemed impracticable to remove the thick overburden and the clay layer above the rock. The method of foundation stabilization used under shallow fills was to sink several concrete piers through the soft layers into the underlying rock. The reinforcing was extended only a few feet above the soft layer so as to make each pier act as a shear key rather than as a laterally loaded column. If the piers had been extended through the entire column of overburden, the bending moments would have been so great as to render the piers uneconomical and impracticable. The concrete columns, 30 in. in diameter, were staggered in two rows 10 ft on centers, making the effective spacing 5 ft on centers. In this case reinforced concrete piers were used to stabilize the clay layer.

FIG. 2. A typical design section through the lower part of the Mira Loma Park development below elevation shows grades and stabilization features.



New composite-beam concepts

FRANK D. STEINER

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Greater use can economically be made of composite beam construction. The solution of design problems by a graphical method can speed planning and increase the use of this method of construction.

Simplified graphical design method

By graphics three major problems can be solved in minutes, namely:

1. Locating the neutral axis (NA) and obtaining the I of the composite beam section when the concrete deck and the wide-flange beam are given.

2. Obtaining the size of the wide-flange beam and I of the composite section when the concrete deck and the position of the neutral axis are given.

3. Determining the size of the concrete deck and obtaining the I of the composite beam section when the wide-flange beam and the position of the neutral axis are given.

One of the notable achievements of the composite beam is the gain in headroom. However, the American Association of State Highway Officials (AASHO) has set the minimum L/D (length to depth) ratios for highway bridges at 25 for the overall depth, and at 30 for the depth of the wide-flange beam respectively. Research and experience may one day give us even better ratios, particularly for industrial buildings.

For each given concrete deck and span L, there is an optimal wide-flange shape based on AASHO L/D ratios with a minimum of shear anchors, which occurs when the neutral axis intersects the web of the wide-flange beam at the under side of the top flange.

Conversely, each given wide-flange shape and span L has an optimal concrete deck when the neutral axis is located on the under side of the top flange. The first of these two conditions is depicted in Fig. 1 (a). Given are the concrete deck, the overall depth D based on L/D minimum ratios, and the position of the neutral axis. Required are the size of the wide-flange shape and I of the composite beam section.

With the axis of concrete, A_c, and the axis of steel A_s, located thus (and the magnitude of A_s still unknown), it is merely necessary to draw the lines "1" and "2" in the funicular polygon, Fig. 1 (b), parallel to the lines "1 a" and "2 a" of the force polygon (area polygon) of Fig. 1 (c).

In the force polygon, the concrete area A_c must be transformed by the ratio $1/n$. Since the slope of the line "2" is determined, and line "2 a" is parallel to it, the area A_s of the optimal wide-flange shape can be scaled, and the corresponding shape picked from the steel handbook. It could hardly be simpler.

The I of the composite beam section is found immediately by the empirical formula, $I=1.5\ HF$, yielding values with an accuracy of ± 5 percent. The F in this expression is the hatched triangle, Fig. 1 (b), whose base and height are scaled—using the scale of Fig. 1 (a). The H is the polar distance measured in the scale of the force polygon, Fig . 1 (c). Actually, H is quite arbitrary, and for the designer's convenience always a multiple of 10, 100, etc.

This approach is almost always satisfactory for both preliminary and final designs. If it is desired to use the exact method, which is recommended for unusual or irregular concrete deck sections, the procedure is as follows.

There are two force (area) polygons —one for the concrete deck and the other for the wide-flange shape, Fig. 1 (c)—and two corresponding funicular polygons, Fig. 1 (b), converging at the intersection of the neutral axis.

The exact method requires the subdivision of both concrete deck and wide-flange shape into narrow, parallel strips, letting their individual areas act as forces. When drawing the funicular polygons (starting from the top down for the deck, and from the bottom up for the wide-flange shape) it will be seen that the area F is not a triangle but a shape with a straight vertical base and two curved lines (the funicular polygons) converging at the intersection with the neutral axis.

Experience has shown that the triangle is about 33 percent larger than the exact, curved area F. The moment of inertia obtained by the exact method is $I=2\ HF$. The approximate, and much easier, method yields $I=1.5\ HF$, F being a triangle.

The graphical method is exact for symmetrical sections only but the error is not serious for a slight asymmetry. The method is particularly useful when dealing with other than rectangular shapes, such as that shown in Fig. 3(a).

As stated at the outset, the unknowns in this problem can be reversed

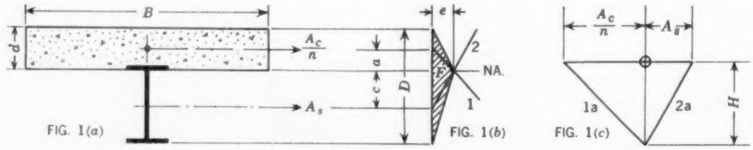


FIG. 1(a) FIG. 1(b) FIG. 1(c)

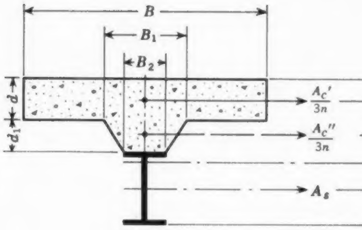


FIG. 2(a)

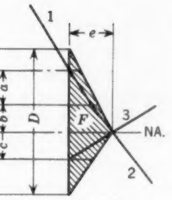


FIG. 2(b)

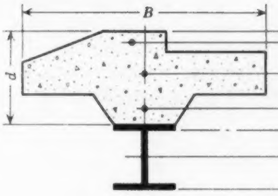


FIG. 3(a)

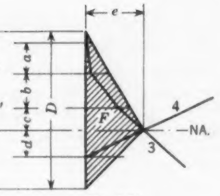


FIG. 3(b)

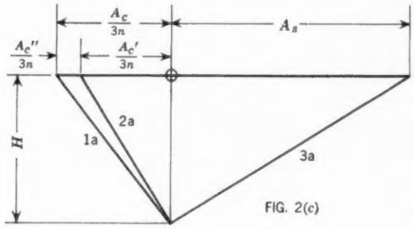


FIG. 2(c)

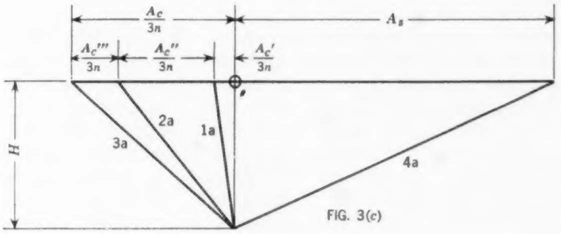


FIG. 3(c)

as outlined in paragraphs Nos. 1 and 3. Values are found rapidly with a few pencil lines and simple arithmetic.

Some day a designer may be tempted to tabulate all the concrete decks within a practical range, and assign to each the optimal wide-flange section. However, since this will be a rather arduous task, the quick, simplified graphical method will render the same service and will free the designer from "book" designing. When a concrete deck is of unusual shape, the graphical method seems to be the designer's only rational approach.

Steel-plate armored concrete structures

When designing trestles, frames or towers for heavy installations, such as steam turbine generators, the columns and beams invariably become very bulky because of the rigorous and exacting design requirements for reduced stresses and minimum deflections. Not only do the members have extraordinary bulk, but the closely spaced, heavy reinforcement presents a problem for both designer and constructor.

Experience has shown that it is difficult to place the concrete in heavily reinforced structures as the bars do not permit the passage of vibrators. Anchor bolts, pipe sleeves, inserts, conduits, ducts and other embedded items hamper easy concreting and jeopardize the quality of the finished product.

Frequently high-slump concrete must be used, with inevitable loss of strength and greater shrinkage. Outside vibration must be resorted to, which calls for rugged forms and good shoring. In spite of all these measures, it is questionable whether all the reinforcing bars will be thoroughly embedded in the concrete. Here, unquestionably, is an opportunity to enlarge the scope of the composite beam.

A section of a heavily reinforced T-beam is shown in Fig. 4. Steel savings of from 20 to 40 percent can be achieved if the composite-beam principle is applied. In Fig. 5, the reinforcing bars are replaced by an 18-in. channel with stud anchors, resulting in a reduction of steel of 20 percent. Even greater economy (40 percent) is obtained by using a bottom plate with a suitable anchorage (Fig. 6).

FIG. 4

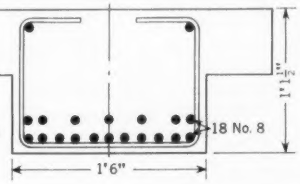


FIG. 5

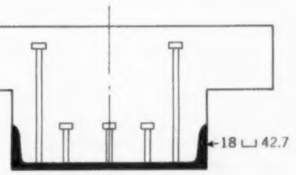
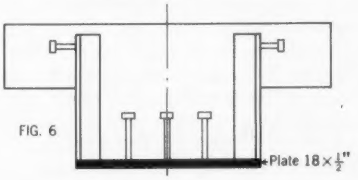


FIG. 6



The plate (or the channel), including shear connectors, comes in one piece. It can be lifted by crane from the truck and placed on shoring between its supports. Only the vertical sides of the beams require forming. Negative reinforcing at the supports can consist either of reinforcing bars or of a series of vertical steel plates with shear connectors. Concrete placing is easier and faster. Moreover, a steel-plated beam bottom is an ideal medium for various attachments, such as pipe hangers. The savings in labor and formwork are equally impressive.

The reinforced-concrete beam section shown in Fig. 7 is a true reproduction of an actual design. Both the installation of the reinforcing and the placing of the concrete were a contractor's headache.

The equivalent, steel-plate armored counterpart is shown in Fig. 8. It is a shop-fabricated steel form, shipped as

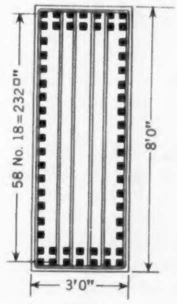


FIG. 7

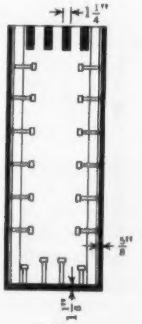


FIG. 8

a unit and placed in one piece. A careful analysis of the two beam sections revealed a saving in steel of 14 percent. Additional advantages are:

Low-slump concrete and higher strength
Formwork and reinforcing the same in both, with no honeycombing and no patchwork
Faster installation and faster pouring
Greater torsional resistance of the section
Unlimited facilities for attaching studs or inserts for the support of equipment

The composite-beam principle is equally suitable for columns. The steel-plate armor takes the place of the reinforcing bars. It would hardly be feasible or economical to use the steel-plate armor on a few isolated beams and columns in a structure. It is a case of all or none. Either a structure is

completely armored with steel plate or not at all. A compromise is not practicable.

The steel-plate armor—always studded inside with shear connectors of computed value—for a trestle, frame or tower does not come in one piece. The individual members—girders, beams and columns—are shop fabricated and shipped separately. Their assembly at the job site requires butt welding of the joints. Multi-story structures are installed one story at a time, and the pouring sequence must be so scheduled as to avoid undue shrinkage stresses. Concrete slabs spanning between beams, and concrete walls between columns, are poured later. The connections with the steel-plate armor of the supporting members are accomplished with welded studs to which the slab (or wall) reinforcing can be welded. Such slabs and walls can be formed in the conventional manner.

The bulky, two-story frame of Fig. 9 supports a heavy steam-turbine generator which is particularly well suited to the use of steel-plate armor reinforcing. Similar heavy supports for

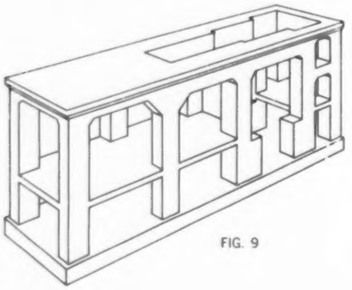


FIG. 9

compressors, crushers, missile launching pads and the like lend themselves to the use of such reinforcing with a saving in construction dollars.

No provision has been made in building codes, except that of the AASHO, for composite-beam construction or the proposed use of steel-plate armor reinforcing. The value of the construction dollar will be best preserved by giving these more economical methods an opportunity to prove their superiority.

The prestressed composite beam

The idea of prestressing a composite beam really originated in a carpenter's workshop many years ago when doweled timber beams were still in use. Before the oaken dowels were set into the accurately cut grooves between the individual beams (usually two or three), the entire assembly, which rested on a level floor, was cambered by means of heavy screws or wedges. The amount of camber was determined by rule of thumb and sound judgment. Although the cambering of doweled timber beams was the artisan's device for preventing undue slackening of the dowels and visible sagging of the beam, it also was what we call today "prestressing of a flexural member." It is almost certain that this was the last thing the carpenter had in mind.

The prestressing of a composite beam consisting of a wide-flange shape and a concrete deck is in essence the same as the cambering of a doweled timber beam. When the wide-flange shape is fastened to its supports, it is jacked up at the center or at its third points to a computed deflection which corresponds to the desired "prestress," that is, flexural stresses of say ±20,000 psi. It will be more convenient to compute the thrust P of the jack that produces the desired prestress, and let the hydraulic jack act to just that extent. (See Figs. 10 and 11.)

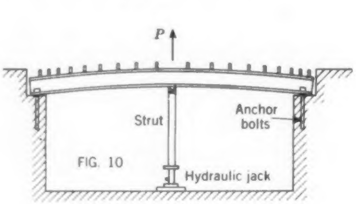


FIG. 10

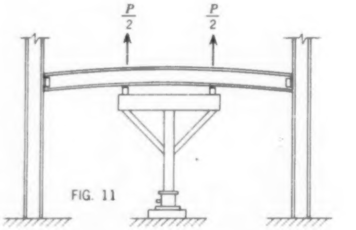


FIG. 11

While the wide-flange shape is under prestress, the concrete deck is placed, and the jack remains in place until the concrete has almost reached its full design strength. This obviously calls for high early strength cement and concrete of superior quality.

As long as the jack is in place, there is a compression of −20,000 psi in the bottom flange, and a tension of +20,000 psi in the top flange. After the jack is released, the bottom flange has a stress potential of +40,000 psi, namely from −20,000 psi to +20,000 psi. If the neutral axis of the composite beam is kept flush with the bottom of the top flange, it is evident that the stresses in the top flange are but little affected by the loads of the composite beam. Theoretically, they will stay just a trifle under +20,000 psi, regardless of the type or manner of loading.

The stress diagram of the single wide-flange shape under prestress, and that of the composite beam can be superimposed, since the concrete deck is completely in the compression zone (Fig. 12).

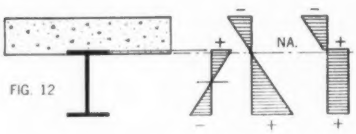


FIG. 12

The upward thrust P, from the hydraulic jack, is reversed and acts as a downward load on the composite beam the moment the jack is removed, and from then on P is a permanent load that must be reckoned with in the design.

In a balanced design it is obvious that the high stress potential of the bottom flange (+40,000 psi) can only be matched by a correspondingly high stress in the concrete deck, that is up to about $f_c = 2{,}400$ psi. While the structural-steel shape still has about $E_s = 29{,}000{,}000$ psi, the deck concrete will go as high as $E_c = 6{,}000{,}000$ psi, and $n = E_s/E_c = 5$, which will play a considerable role when concrete areas are transformed into "steel." However, the long-term loading due to P involves the use of a multiplier for n, as recommended by good practice. Since P is only a relatively small fraction of the total load capacity of the composite beam, a multiplier of 2 was used. (A multiplier of 3 is recommended for long-term full live-load as in warehouses or storage tanks.)

A comparative analysis of a number of prestressed composite beams, composite beams not prestresed, and conventional, non-composite beams revealed some very interesting data.

Beam	Resisting Moment, %
Non-composite wide-flange beam	100
Composite beam, not prestressed	145
Composite beam, prestressed	190

Since the resisting moment of a section is in direct relation to the load capacity, assuming the same span length and the same type of loading, it follows that the prestressed composite beam is able to carry nearly twice the load of the non-composite beam. However, this gain can only be accomplished by using a number of improvements and refinements. These include the use of shear anchors (or studs), high-early-strength cement and top quality concrete, and a hydraulic jack for the prestressing. There is also a time element.

There is no doubt that creep and plastic flow will probably affect the final stress diagram. Only long-range research will yield the best procedure for the design and construction of the prestressed composite beam. Most new techniques have proved uneconomical and impracticable at their inception, but research and development have brought many of them into positions of leadership in their respective fields.

AMERICAN SOCIETY OF CIVIL ENGINEERS

New Orleans Convention

Headquarters, Jung Hotel, New Orleans, La. **March 7-11, 1960**

REGISTRATION

Jung Hotel, Mezzanine

Sunday, March 6, 2:00 to 5:00 p.m.

Monday through Thursday, March 7-10, 8:00 a.m. to 5:00 p.m.

Friday, March 11, 8:00 a.m. to noon

Registration fee for members and guests $5.00. No charge for ladies and students.

Special note to those observing the Lenten Season: A choice of meat or fish will be offered at each luncheon throughout the Convention.

HOTEL ACCOMMODATIONS

The Jung Hotel, 1500 Canal Street, will be official headquarters for the Convention. Special arrangements have been made to place as many as possible in the headquarters hotel. A reservation request coupon appears on page 146. You are urged to send your request early to assure space at the Jung. All sessions of the Convention will be held here.

AUTHORS' BREAKFASTS

7:30 a.m. **Room 9**

Each Convention day, briefing sessions are held for speakers, discussers and program officials. Admission is by invitation only.

Walter E. Blessey, Chairman of the Technical Program Committee, will preside at these sessions.

LOCAL SECTIONS CONFERENCE

Monday, March 7 and Tuesday, March 8

9:00 a.m. **Rooms 4 and 5**

Representatives of ASCE Local Sections from a selected area about the Convention city will convene for discussion related to the expansion of the Society's activities at the local level.

This conference, which is primarily for invited delegates of the selected Local Sections, is open to all who may be interested in the fundamentals of Section operation.

MONDAY MORNING MARCH 7

City Planning and Irrigation and Drainage Divisions, Joint Session

9:30 a.m. **Tulane Room**

9:30 **Salient Features of the New Orleans Drainage System**

H. C. Swan, Electrical Engr., Sewerage and Water Board of New Orleans.

10:15 **The Application of Large Propeller Pumps to Land Drainage**

D. D. Modianos, Mechanical Engr., Sewerage and Water Board of New Orleans.

11:00 **The Importance of Planning for Drainage Prior to Construction**

Robert L. Atkinson, Chief Engr., New Orleans East, Inc.

ICE-BREAKER PARTY

Monday, March 7 **5.30-7:00 p.m.**

Tulane Room **Jung Hotel**

All those who have paid the registration fee, and their wives, are cordially invited to enjoy the hospitality of the Louisiana Section at this first general gathering of the Convention. An opportunity to meet and greet old friends and new with cocktails.

HARBOR TOURS

Tuesday through Friday, March 8-11, 2:00 p.m.

Tour of entire length of New Orleans Harbor, Mississippi River, on yacht *Good Neighbor*, courtesy of New Orleans Dock Board.

Boat will depart from foot of Canal Street (Eads Plaza) and Mississippi River promptly at 2:00 p.m. and return to Eads Plaza at 3:30 p.m. Trip is limited to 40 persons each day. Wives and students invited. Convenient public transportation to Eads Plaza is available in front of Jung Hotel.

Tickets for the tour will be available at the Registration Desk.

No charge.

Construction Division

9:00 a.m. **Room 2**

Presiding: Lyman D. Wilbur, Chairman, Exec. Committee, Construction Div.

9:00 **The Use of Admixtures in Concrete**

Melville E. Prior, Technical Service Manager, Construction Chemicals Dept., W. R. Grace & Co., Dewey & Almy Chemical Div., Cambridge, Mass.

9:30 **Precast and Prestressed Concrete for Industrial Construction in the Southwest**

John C. Fitch, Vice President and General Manager, The Rackle Co. of Texas, Cleveland, Ohio.

10:00 **Marine Oil Terminal for Rio de Janeiro, Brazil**

H. W. Reeves, Staff Engr., Brown & Root, Inc., Houston, Tex.

10:30 **Discussion**

Pipeline Division

9:00 a.m. **Rooms 9 and 10**

Presiding: Fred C. Culpepper, Chairman, Exec. Committee

9:00 **Remote Control of Offshore Compressors by Microwave**

W. E. Matthews, Southern Natural Gas Co., Birmingham, Ala.

9:45 **Special R. O. W. Problems Encountered in the Southern Louisiana Area**

B. J. Whittley, Tennessee Gas Transmission Co., Houston, Tex.

10:30 **Construction of a Seven-Mile Underwater Hot Sulfur Pipeline**

Edward J. McNamara, Freeport Sulfur Co., New Orleans, La.

Waterways and Harbors Division

9:15 a.m. Room 1

Presiding: Lawrence B. Feagin, Member, Executive Committee, Waterways and Harbors Division

Session of Committee on Ports and Harbors: Wharf Design Symposium

9:15 **Planning Features of Elizabeth Port Authority Piers**

GUY F. TOZZOLI, Manager, Marine Planning and Construction Div., Port of New York Authority.

10:00 **Studies for Types of Construction at Elizabeth Port Authority Piers**

JOHN S. WILSON, Engr. of Design, Marine Terminals, Port of New York Authority.

10:45 **Wharf Construction at Port of Long Beach**

BOB N. HOFFMASTER, Chief Harbor Engr., Port of Long Beach, Calif.

MONDAY AFTERNOON MARCH 7

Construction and Waterways and Harbors Divisions, Joint Session

2:30 p.m. Tulane Room

Presiding: Lawrence B. Feagin, Member, Exec. Committee, Waterways and Harbors Div.

2:30 **Stabilization of the Lower Mississippi River**

RAYMOND H. HAAS, Chief, Construction Branch, Miss. River Commission, Vicksburg.

3:15 **Casting an Articulated Concrete Mattress**

RUSSELL C. BAKER, Chief, Construction Div., U. S. Army Engineer Dist., Vicksburg.

4:00 **Mississippi River Revetment, Plant and Methods**

J. IRA BOSWELL, Chief, Construction and Maintenance Branch, U. S. Army Engineer Dist., Vicksburg.

Hydraulics Division

2:00 p.m. Room 2

Session on Hydrology

Presiding: Eugene P. Fortson, Jr., Member, Exec. Committee, and David K. Todd, Member, Hydrology Committee

2:00 **An Appraisal of the Stream Gaging Network in the United States**

JOHN E. MCCALL, Dist. Engr., U. S. Geological Survey, Trenton, N. J.

2:45 **Seepage Through Layered Anisotropic Porous Media**

DAVID K. TODD, Assoc. Prof. of Civil Eng., and JACOB BEAR, Graduate Research Engr., Univ. of Calif., Berkeley.

3:30 **Pressure Distribution in Partially Saturated Porous Media During Steady Flow of Immiscible Fluids**

VERNE H. SCOTT, Assoc. Prof. of Irrigation, Univ. of Calif., Davis.

4:15 **New Emphasis on Water Resources in ASCE**

CARL E. KINDSVATER, Prof. of Civil Eng., Georgia Inst. of Tech., Atlanta.

WELCOMING LUNCHEON

Monday, March 7

12:30 p.m. Charcoal Room

Speaker: HON. DELESSEPS S. MORRISON, Mayor, City of New Orleans.

Presiding: FRANK A. MARSTON, President, ASCE.

Toastmaster: ROY T. SESSUMS, Chairman, New Orleans Convention Committee, ASCE.

All members, guests, and friends of the Society are invited to attend.

Tickets for this event should be purchased before 11:00 a.m. on Monday, March 7.

Per plate, $3.50.

Pipeline Division

2:00 p.m. Room 1

Presiding: Donald E. Adams, Secretary, Exec. Committee, Pipeline Div.

2:00 **Corrosion Control of Marine Pipelines**

EDWARD DOREMUS, Cathodic Protection Service Co., Houston, Tex.

2:45 **Construction Procedures Employed on the Delta Pipeline**

DONALD C. SIMPSON, Shell Pipe Line Corp., Houston, Tex.

3:30 **Land and Pipeline Location Surveying in the Coastal Areas**

CARL E. HECK, Thiboudeaux, La.

TUESDAY MORNING MARCH 8

Construction Division

9:00 a.m. Rooms 9 and 10

Presiding: Walter L. Couse, Member, Exec. Committee, and Roy G. Cappel, W. Horace Williams Co., New Orleans, La.

9:00 **Long-Span Prestressed Concrete Folded-Plate Roofs**

JOHN C. BROUGH, JR., Consulting Engr., Memphis, Tenn.

9:30 **The Havana Tunnel**

JOSE MENENDEZ MENENDEZ, Edificio Bacardi, Havana, Cuba.

10:00 **The Design and Construction Features of a Grandstand and Club House (Scioto Downs)**

R. M. GENSERT, Gensert, Williams & Assocs., Cleveland, Ohio.

10:30 **Planning for the Contractor for Construction of the Old River Locks**

ROSS WHITE, Vice President, Brown & Root, Inc., Houston, Tex.

PIPELINE DIVISION FIELD TRIP

Tuesday, March 8, 9:30 a.m.

Visit to pipe-coating yards of the H. C. Price Co., and other pipe-coating facilities in New Orleans area.

Buses will leave the Canal Street entrance of the Jung Hotel at 9:30 a.m. sharp. The first stop will be the Pipe Line Service Corp. yard on Harvey Canal. The next stop will be at the H. C. Price Co. coating yard, Harvey, La., where a courtesy barbecue lunch will be served.

Tour will return to Jung Hotel at approximately 3:00 p.m.

Transportation cost per person, $2.00.

Tickets will be available at the Registration Desk, but reservations will have to be made no later than 5:00 p.m. Monday.

Structural Division

9:00 a.m. Tulane Room

Presiding: Bernhard Dornblatt, Director ASCE

Opening Remarks: R. D. Dewell, Chairman, Exec. Committee, Structural Div.

9:00 **Composite Prestressed Girders, Streamlined Economical Ware-**

house, McGraw-Hill Book Distribution Center, East Windsor Township, N. J.

PHILIP M. GRENNAN, Alfred Easton Poor, Architects, New York, N. Y.

9:30 **The Application of Prestressing to Cylindrical Concrete-Shell Roof Structures**

JOHN B. SKILLING, Worthington, Skilling, Helle & Jackson, Consulting Engineers, Seattle, Wash.

10:00 **Prestressed Concrete Piles**

T. Y. LIN, Prof. of Civil Eng., Univ. of Calif., Berkeley, Calif.; and W. J. TALBOT.

GENERAL MEMBERSHIP LUNCHEON

Tuesday, March 8

12:30 p.m. Charcoal Room

Speaker: MAJ. GEN. WILLIAM A. CARTER, U. S. Army; President, Mississippi River Commission; Div. Engr., Lower Mississippi Valley Div.

Subject: The River Engineer—His Problems and Opportunities for Service

Presiding: FRANK A. MARSTON, President, ASCE.

Toastmaster: WALTER E. BLESSEY, Chairman, Technical Program Committee, New Orleans Convention, ASCE.

All members, guests, and friends of the Society are invited to attend.

Tickets for this event should be purchased before 11:00 a.m. on Tuesday, March 8.

Per plate, $3:50.

TUESDAY AFTERNOON MARCH 8

Construction and Waterways and Harbors Divisions, Joint Session

2:30 p.m. Room 1

Presiding: Joe W. Johnson, Chairman, Exec. Committee, Waterways and Harbors Div.

2:30 **Economics of Bank Stabilization**

CHARLES SENOUR, Consulting Engr., Coral Gables, Fla.

3:00 **Mississippi River Tributary Bank Protection Types**

HARVILL E. WELLER, Channel Stabilization Sect., Miss. River Commission, Vicksburg, Miss.

3:30 **Stabilization Plan for the Arkansas River**

EDWARD B. MADDEN, Hydraulic Engr., U. S. Army Engineer Dist., Little Rock, Ark.

4:00 **Southwest Pass—Mississippi River 40-ft Ship Channel**

AUSTIN B. SMITH, Chief, Navigation, Mapping and Dredging Branch, Miss. River Commission, Vicksburg, Miss.

Hydraulics Division

2:00 p.m. Room 2

Hydromechanics Session

Presiding: Eugene P. Fortson, Jr., Member, Exec. Committee, and Fred R. Brown, Member, Hydromechanics Committee

2:45 **Vibration in Hydraulic Structures**

F. B. CAMPBELL, Chief, Hydraulic Analysis Branch, Waterways Experiment Station, Vicksburg.

3:30 **The Damping of Oscillatory Waves Due to Laminar Boundary Layers**

P. S. EAGLESON, Asst. Prof., Hydraulic Eng., Mass. Institute of Tech., Cambridge.

4:15 **Secondary Flows and Free Surface Phenomena in Straight Open Channels**

J. W. DELLEUR, Assoc. Prof. of Hydraulic Eng., Purdue Univ., Lafayette, Ind.

Structural Division

2:30 p.m. Tulane Room

Experimental Research

Presiding: C. T. G. Looney, Secretary, Exec. Committee

2:30 **Effects of Freezing and Thawing on Prestressed Concrete**

M. J. GUTZWILLER, Prof., Purdue Univ., Lafayette, Ind.; and F. E. MUSLEH.

3:00 **Shear Tests on Beams with Web Reinforcing**

G. HERNANDEZ, Dept. of Civil Eng., Univ. of Illinois, Urbana; M. A. SOZEN, and C. P. SIESS.

3:30 **New Facilities for Research on the Fire Resistance of Prestressed Concrete**

HUBERT WOODS, Director of Research, Portland Cement Assoc., Research and Development Labs., Skokie, Ill.

4:00 **Laboratory Tests on a Two-Span Continuous Precast Prestressed Bridge**

ALAN H. MATTOCK, Senior Development Engr., Structural Development Sect., Research and Development Labs., Portland Cement Assoc., Skokie, Ill.; and PAUL KAAR.

WEDNESDAY MORNING MARCH 9

Conditions of Practice Department

9:30 a.m. Tulane Room

Presiding: Paul L. Holland, Chairman, Dept. of Conditions of Practice

Session of Committee on Engineering Education

Panel Discussion

ECPD Accreditation of Engineering Curricula—Procedures and Policies

Moderator: Armour T. Granger, Dean of Engineering, University of Tennessee, Knoxville.

9:30 **What the Institution Does**

LEE H. JOHNSON, JR., Dean of Engineering, Tulane Univ., New Orleans.

AWARDS LUNCHEON

Wednesday, March 9

12:30 p.m. Tulane Room

Speaker: MORROUGH P. O'BRIEN, Dean Emeritus, University of California, Berkeley.

Subject: Research and the Future of the Civil Engineering Profession

Presiding: FRANK A. MARSTON, President, ASCE.

Toastmaster: HAROLD B. GOTASS, Chairman, Research Committee, ASCE.

Research Awards to:

CHARLES L. BRETSCHNEIDER, Research Div., Beach Erosion Board, Corps of Engineers, Washington, Va.

NORMAN H. BROOKS, Calif. Inst. of Technology, Pasadena.

ARTHUR CASAGRANDE, Harvard Univ., Cambridge, Mass.

DANIEL FREDERICK, Virginia Polytechnic Inst., Blacksburg.

GEORGE S. VINCENT, U. S. Bur. of Public Roads, Washington, D. C.

Research Fellowship Report: ROBERT W. GERSTNER, Northwestern Univ., Evanston, Ill.

All members, guests and friends of the Society are invited to attend.

Tickets for this event should be purchased before 11:00 a.m. on Wednesday, March 9.

Per plate, $4.00.

What the ECPD Visitation Team Does

CLARENCE H. AX, ASCE Representative to ECPD, St. Louis, Mo.

Review and Evaluation of Inspection Reports by ECPD

WILLIAM P. KIMBALL, Dean, Thayer School of Eng., Dartmouth College, Hanover, N. H.

Questions and discussion from the floor

Session of Committee on Registration of Engineers

11:00 **Legal Matters Affecting Engineers—a discussion of recent cases bearing on the engineer's responsibility and liability in connection with consulting services and supervision of construction**

R. EMMET KERRIGAN, ESQ., Deutsch, Kerrigan and Stiles, Attorneys, New Orleans.

WEDNESDAY AFTERNOON MARCH 9

Pipeline Division

2:00 p.m. Rooms 9 and 10

Presiding: David R. Williams, Jr., Member, Executive Committee

2:00 **What We Know and Don't Know About Buoyancy of Marine Pipelines**

RAYMOND H. CROWE, Transcontinental Gas Co., Houston, Tex.

2:45 **Various Designs of Mississippi River Crossings Due to Location and Condition**

LEO ODUM, Ryburn & Odum, Consulting Engrs., Baton Rouge, La.

3:30 **Pipeline Crossings by the Clear Span Method**

McCALL FITZPATRICK, Clear Span Engineering Co., Houston, Tex.

Soil Mechanics and Foundations Division

2:00 p.m. Room 1

Presiding: Jorj O. Osterberg, Chairman, Exec. Committee, Soil Mechanics and Foundations Div.

2:00 **Common Sense and Preconsolidated Clays**

SPENCER J. BUCHANAN, Principal Engr., Spencer J. Buchanan & Associates, Bryan, Tex.

2:45 **Transmission of High Loads to Primary Formations by Large-Diameter Shafts**

RAYMOND C. MASON, Partner, Mason-Johnson & Assoc., Dallas, Tex.

3:30 **Fundamental Aspects of Thixotropy in Soils**

JAMES K. MITCHELL, Asst. Prof. of Civil Eng., Univ. of Calif., Berkeley.

4:15 **The Effect of Time on the Shearing Strength of Clays**

E. C. W. A. GEUZE, Prof. of Civil Eng., Delft Technological Univ., Holland.

Structural and Construction Divisions, Joint Session

2:30 p.m. Tulane Room

Presiding: Carl B. Jansen, Dravo Corporation, Pittsburgh, Pa., and Nathan D. Whitman, Jr., Member, Exec. Committee, Structural Div.

2:30 **Bulkheads and Retaining Walls Using Prestressed Concrete Sheet-piles**

W. E. DEAN, Asst. State Highway Engr. (Structural), Florida State Road Dept., Tallahassee.

3:00 **Champlain Bridge, Montreal, Quebec**

R. M. DUBOIS, President, Freyssinet Co., Inc., New York, N. Y.

3:30 **The Oneida Lake Bridge Construction**

ERIC C. MOLKE, Summers, Munninger & Molke, Consulting Engrs., Albany, N. Y.

4:00 **Construction Concept, Design, and Economics of Cast-in-place Post-tensioned Concrete Bridges of Over 100-Ft Span**

MORRIS SCHUPACK, Schupack & Zollman, Consulting Engrs., Stamford, Conn.

Waterways and Harbors Division

2:30 p.m. Rooms 4 and 5

Presiding: R. O. Eaton, Vice Chairman, Exec. Committee, Waterways and Harbors Div.

Session of Committee on Coastal Engineering

2:30 **Hurricane Study of Lake Pontchartrain and Vicinity**

WALTER S. MASK and P. ALFRED BECNEL, JR., Hydrology and Meteorology Sect., U. S. Army Engineer Dist., New Orleans.

3:00 **Studies of a Channel Through Padre Island, Texas**

EVERETT A. HANSEN, Dist. Engr., U. S. Army Engineer Dist., Galveston, Tex.

3:30 **Design of Inlets for Texas Coastal Fisheries**

H. P. CAROTHERS, Asst. Head, Civil Div., and HOMER C. INNIS, JR., Head of Corpus Christi Office, Lockwood, Andrews and Newnam, Consulting Engineers, Houston, Tex.

4:00 **The Shark River Inlet Sand By-passing Project**

W. MACK ANGUS, Consulting Engr., N. J. State Navigation Bur., and Chairman, Dept. of Civil Eng., Princeton Univ.

DINNER DANCE

Wednesday, March 9

6:30 p.m. Assembly and cocktails in Room 1

7:30 p.m. Dinner in Tulane Room

Dress optional.

This social evening will begin with fellowship and a delightful meal, followed by dancing to the music of an outstanding New Oreans orchestra. There will be no reserved tables and friends are encouraged to arrange their own groups.

Table service will be available after dinner.

Per plate, $10.00.

THURSDAY MORNING MARCH 10

ECPD INSPECTORS' BREAKFAST

Thursday, March 10

8:00 a.m. Room 3

Highway Division

9:00 a.m. Rooms 9 and 10

Presiding: R. B. Richardson, Director, Louisiana Dept. of Highways, Baton Rouge

9:00 **Interstate Highways in the New Orleans Area**

A. D. JACKSON, Deputy Chief Engr., Louisiana Dept. of Highways, Baton Rouge.

9:30 **Photogrammetry and Electronics in Highway Location and Design**

J. C. BARRETT, Asst. Photronics Engr., Mississippi State Highway Dept., Jackson.

10:00 Rural Intersection Illumination Studies

HUBERT HENRY, Supervising Designing Engr., Texas Highway Dept., Austin.

10:30 Traffic Studies Relative to the Design of Freeway Ramps

JACK KEESE, Prof., Texas A. & M. College, College Station.

Hydraulics Division

9:00 a.m. Room 2

Flood Control Session

Presiding: Eugene P. Fortson, Jr., Member, Exec. Committee; and E. J. Williams, Jr., Member, Flood Control Committee

9:00 Problems Involved in the Distribution of Flow at and Below the Latitude of Old River

FRED M. CHATRY, Asst. Chief, Hydraulic Design Sect., Corps of Engineers, New Orleans.

9:45 Sedimentation Aspects in the Diversion at Old River

FRED B. TOFFALETI, Chief, Hydraulic Model and Sedimentation Sect., Miss. River Commission, Vicksburg.

10:30 Diversion from the Mississippi River by Bayou la Fourche, La., Pumping Station

HU B. MYERS, Chief Engr., Louisiana Dept. of Public Works, Baton Rouge.

11:15 Maximum Results from Limited Available Information in Hydraulic Computations

C. K. OAKES, Chief, Hydraulic Sect., Louisiana Dept. of Public Works, Baton Rouge.

Power Division

9:00 a.m. Rooms 4 and 5

Presiding: Richard R. Randolph, Jr., Secretary, Exec. Committee, Power Division

9:00 Private Power Development of an Entire River

RICHARD S. WOODRUFF, Senior Engr., Alabama Power Co., Birmingham.

9:30 Adding a Powerhouse

GALE B. DOUGHERTY, Principal Hydraulic Engr., and R. R. RANDOLPH, JR., Manager, Hydro Projects Sect., Southern Services, Inc., Birmingham.

10:00 Multiple-Purpose Power Plant Capacity

RICHARD E. KRUEGER, Mechanical Engr., Dept. of the Interior, U. S. Bur. of Reclamation, Div. of Design, Hydr. Machinery Branch, Office of Asst. Commissioner and Chief Engr., Denver, Colo.

10:30 Discussion

GENERAL MEMBERSHIP LUNCHEON

Thursday, March 10

12:30 p.m. Charcoal Room

Speaker: JOHN CHASE, Editorial Cartoonist, The New Orleans States and Item.

Subject: The Low-Down on New Orleans

Presiding: FRANK A. MARSTON, President, ASCE.

Toastmaster: BERNHARD DORNBLATT, Director, District 15, ASCE.

All members, guests, and friends of the Society are invited to attend.

Tickets for this event should be purchased before 11:00 a.m. on Thursday, March 10.

Per plate, $3.50.

Structural Division

9:00 a.m. Tulane Room

Bridges

Presiding: G. S. Vincent, Member, Exec. Committee, Structural Div., and Thor Germundsson

9:00 Lightweight Concrete in Bridges

WAYNE HENNEBERGER, Supervising Designing Engr., Bridge Div., Texas Highway Dept., Austin.

9:30 Friction Coefficients Verified on Little Falls Bridge

DAVID I. HENDERSON, Black & Veatch, Consulting Engrs., Kansas City, Mo.

10:00 Field Survey of Prestressed-Concrete Bridges

ALFRED L. PARME, Manager, Structural and Railways Bur., Portland Cement Assoc., Chicago, Ill.; and R. S. FONTAIN.

Soil Mechanics and Foundations Division

9:00 a.m. Room 1

Presiding: R. A. Barron, Member, Exec. Committee, Soil Mechanics and Foundations Div.

9:00 The High-Volume-Change Clays of the Eastern Coastal Plain

GEORGE F. SOWERS, Prof. of Civil Eng., Georgia Inst. of Tech.; G. M. KENNEDY, and G. B. DALRYMPLE, Soil Engrs., Law-Barrow-Agee Labs, Inc., Atlanta, Ga.

9:45 The Influence of Predicted Long-Time Heave on Multi-Story Building Design

BRAMLETTE MCCLELLAND, McClelland Engrs., Houston, Tex.

10:30 Methods of Application of Soil Criteria in the Design of Laterally Loaded Piles

HUDSON MATLOCK, Prof. of Civil Eng., Univ. of Texas; LYMON C. REESE, Prof. of Civil Eng., Univ. of Texas, Austin.

THURSDAY AFTERNOON MARCH 10

Construction and Waterways and Harbors Divisions, Joint Session

2:30 p.m. Room 1

Presiding: Lawrence B. Feagin, Member Exec. Committee, Waterways and Harbors Div.

2:30 Construction of Old River Low-Sill and Overbank Control Structures

JEFFERSON L. SMITH, Chief, Contract Administration Branch, Operations Div., U. S. Army Engineer Dist., New Orleans.

3:00 Plan for Closure of Old River

G. M. COOKSON, Col. U.S.A., District Engr., U. S. Army Engineer Dist., New Orleans, La.

3:30 Unusual Features of Design of Old River Lock

WALDEMAR S. NELSON, President, Bedell and Nelson Engineers, Inc., New Orleans; and A. W. THOMPSON, Senior Partner, A. W. Thompson and Associates, New Orleans.

4:00 Hydraulic Research on Navigation Locks

REX ELDER, Head of Hydraulic Lab., Tennessee Valley Authority, Norris, Tenn.

Highway and City Planning Divisions, Joint Session

2:00 p.m. Rooms 9 and 10

Presiding: John O. Morton, Chairman, Exec. Committee, Highway Div.

2:00 Planning and Financing State Highway Routes in Cities in Alabama

R. D. JORDAN, Chief Engr., State Highway Dept., Montgomery, Ala.

2:30 State Cooperation in Planning Louisiana Urban Facilities

GRADY CARLISLE, Asst. to Director, Dept. of Highways, Baton Rouge, La.

3:00 **The Need for Coordination Between the Highway Program and the Community's Comprehensive Plan**

LOUIS BISSO, President, Planning Services, Inc., New Orleans.

3:30 **Urban Development and the Highway Program**

MARVIN R. SPRINGER, Urban Planning-Area Development Consultant, Dallas, Tex.

Power and Structural Divisions, Joint Session

2:00 p.m. Tulane Room

Session on Transmission Towers

Presiding: Robert J. Druedling, Member, Committee on Session Programs, Power Div., and R. D. Dewell, Chairman, Exec. Committee, Structural Div.

2:00 **Preliminary Design of Guyed Towers**

ROBERT S. ROWE, Prof. and Chairman, Dept. of Civil Eng., Duke Univ., Durham, N. C.

2:30 **Design of Self-Supported Steel Transmission Towers**

RICHARD N. BERGSTROM, Associate, Joseph R. Arena, Structural Engr.; J. M. KRAMER, Design Engr., Sargent and Lundy Engineers, Chicago, Ill.

3:00 **Transmission-Line Construction by Helicopter**

FREDERICK R. PAYNE, JR., Brig. Gen., USMC (Retired) Project Engr., Southern Calif. Edison Co., Los Angeles

3:30 **Discussion**

Soil Mechanics and Foundations Division

2:00 p.m. Room 2

Presiding: Stanley J. Johnson, Member, Exec. Committee, Soil Mechanics and Foundations Div.

2:00 **A Strength Criterion for Failure of Compacted Clay Subject to Repeated Loading**

G. A. LEONARDS, Prof. of Soil Mechanics, Purdue Univ., and H. G. LAREW, Prof. of Civil Eng., Univ. of Virginia.

2:45 **Design and Construction Features of Krotz Springs Barge Dock**

F. EARL HOGAN, Chief, Structural Design Sect., Louisiana State Dept. of Public Works, and LOUIS J. CAPOZZOLI, JR., Vice President and Chief Engr., Engineers Testing Lab., Inc., Baton Rouge, La.

3:15 **Developing a Set of CBR Design Curves**

R. G. AHLVIN, Chief of Reports and Special Projects Sect., U.S. Waterways Experiment Sta., Vicksburg, Miss.

FRIDAY MORNING MARCH 11

Highway Division

9:00 a.m. Rooms 9 and 10

Presiding: Wilson T. Ballard, Chairman, Committee on Geometrics of Highway Design

9:00 **Correlation of Motor-Vehicle and Highway Design**

RICHARD A. HABER, Chief Engr., State Highway Dept., Dover, Del.

9:45 **Spacing of Freeways in the Urban Complex**

JAMES M. PETERSON, Senior Highway Engr., State Div. of Highways, Sacramento, Calif.

10:30 **Geometric Design Features as they Relate to Coordination of Freeway Service with the Local Major Pattern in Urban Areas**

ABRAM N. GEORGE, Senior Highway Engr., State Div. of Highways, Los Angeles, Calif.

Structural Division

9:00 a.m. Tulane Room

Recent Developments

Presiding: E. J. Ruble, Vice Chairman, Exec. Committee, Structural Div.

9:00 **Use of Prestressing in Dam Construction and Problems Associated with it**

O. C. ZIENKIEWICZ, Assoc. Prof. of Civil Eng., Northwestern Univ., Evanston, Ill.

9:30 **Are Prestressed Concrete Ties Practical for American Railroads?**

G. M. MAGEE, Director of Eng. Research, Association of Amer. Railroads, Chicago, Ill.; and F. P. DREW.

Power Division

9:00 a.m. Room 1

Presiding: Marcel P. Aillery, Chairman, Exec. Committee, Power Div.

9:00 **Little Gypsy Power Plant**

G. A. BINGHAM, Principal Engr., Ebasco Services, Inc., New York, N. Y.

9:30 **Power Plant on a Platform at Sea**

H. R. DAVIES, JR., Director, Bedell and Nelson Engineers, Inc., New Orleans; and T. H. ZUMWALT, Senior Civil Eng., Freeport Sulfur Co., New Orleans.

10:00 **The Design of Arch Dams by Use of the Trial Load Method of Analysis**

M. D. COPEN, Concrete Dams Sect., U.S. Bur. of Reclamation, Denver, Colo.

10:30 **Use of Digital Computer in Stress Analysis of Arch Dams**

L. R. SCRIVNER, Concrete Dams Sect., U.S. Bur. of Reclamation, Denver, Colo.

HIGHWAY DIVISION FIELD TRIP

Friday, March 11, 1:30 p.m.

Buses will leave the Canal Street entrance of Jung Hotel at 1:30 p.m. sharp.

Inspection of highway, expressway and overpass construction presently in progress in New Orleans and surrounding areas.

Buses will return to Jung Hotel at approximately 5:00 p.m.

Price per person, $2.00.

Tickets must be purchased by 10:00 a.m. Fri.

POWER DIVISION FIELD TRIP

Friday, March 11 1:30 p.m.

Visit to Little Gypsy Generating Station of Louisiana Power & Light Co., Laplace, La.

Buses will leave the Canal Street entrance of the Jung Hotel at 1:30 p.m. sharp to take those desiring to inspect the Little Gypsy Generating Station of the Louisiana Power & Light Co. presently under construction at Laplace, La.

Buses will return to Jung Hotel at 5:30 p.m.

Price per person, $2.00.

Tickets must be purchased by 10:00 a.m. Friday.

SESSIONS OF THE BOARD

The ASCE Board of Direction will be in session in Room 3 on Monday and Tuesday, March 7-8.

WOMEN'S ACTIVITIES

The Women's Hospitality Center will be open each day during the Convention from 9:30 a.m. to 5:00 p.m. Coffee will be served throughout the day.

In order to afford a maximum of free time for relaxation, random sightseeing, and browsing in the countless antique and curio shops, only two organized events for ladies have been scheduled. Downtown New Orleans and the French Quarter are within easy walking distance of the hotel. Grey Line Tours leave regularly from the Canal Street entrance.

Tuesday, March 8

Breakfast at world famous Brennan's Restaurant, beginning at 10:00 a.m., and a walking tour of the Vieux Carré until 3:30 p.m. $5.50 per person, including transportation.

Thursday, March 10

A snack luncheon at the hotel, beginning at 11:45 a.m., followed by a tour of the fabulous Garden District. $4.00 per person, including transportation.

STUDENT ACTIVITIES

A full program of cenvention activities has been planned for students, including a special session on Tuesday morning and a student paper contest with entries from Louisiana Polytechnic Institute, Louisiana State University, Southwestern Louisiana Institute, and Tulane University.

A highlight of the convention for students will be the Tuesday evening banquet at the Tulane University Center. ASCE Past President Mason G. Lockwood will be the featured speaker and dancing will follow.

Wednesday and Thursday will be devoted to attendance at regular sessions of the Convention and business meetings. Students are invited to a boiled shrimp party at the Falstaff Room Thursday evening. Admission free.

PURDUE ALUMNI BREAKFAST

On Wednesday, March 9, Purdue alumni will meet for breakfast at 8:00 a.m. in Room 4 of the Jung Hotel.

CONVENTION COMMITTEES

Roy T. Sessums, *General Chairman*

Budget Committee
Fred Billingsley, *Chairman*
Frank C. Fromherz

Entertainment Committee
Alvin Fromherz, *Chairman*
Roy G. Cappel, *Vice Chairman*
Charles E. Kolodzey, *Vice Chairman*
G. Arthur Seaver, Jr., *Vice Chairman*
Roy E. Johnson, *Vice Chairman*

Robert F. Bland, Robert Nelson Crews, Chris Demopulos, Holmes Earl, Thomas A. Fromherz, Robert N. Habans, H. Carter Leake, Val A. Lyons, Cecil K. Oakes, Thomas J. Rennie, Martin Standard, Ernest J. Taylor

Excursions
E. J. McNamara, *Chairman*
W. H. French, *Vice Chairman*

D. C. Crawford, M. Dean Keller, T. J. Moody

Hotel
Lee Johnson, *Chairman*

Frank Germano, Richard A. Smith, Wayne P. Wallace, Roy E. Johnson, Emile J. Brinkmann, Jr., Norwood F. Hymel

Printing
Alfred P. Diamond, *Chairman*

John Giddens, Robert Brehan, Arlie Ogle, Harry Stinchomb

Technical Program
Walter Blessey, *Chairman*
Daniel Mehn, John Niklaus

Public Relations and Attendance Promotion
Waldemar S. Nelson, *Chairman*
Joseph T. Montgomery, *Vice Chairman*

Roy Cappel, George Hudson, George Davis, William A. Lewis, Bernard Grehan, Frank MacDonald

Reception
David Godat, *Co-Chairman*
John O'Neill, *Co-Chairman*

Bernard Dornblatt, Randle B. Alexander, Lydon A. Gilman, Eugene M. Zwoyer

Ole K. Olsen, Donald Derickson, William T. Hogg, Charles M. Kerr, Clarence N. Bott, George P. Rice, Clifford H. Stem, William H. Rhodes, Allen J. Negrotto, Norman E. Lant, Frederic N. Billingsley, Alvin M. Fromherz, Leo M. Odom, J. McLean Ledoux, Walter H. Scales, E. M. Freeman, Frank W. MacDonald, Sargent F. Jones, Louis M. Buja, Roy T. Sessums, Lee H. Johnson, Jr., Calvin T. Watts, Bernard A. Grehan, Hu B. Myers, Frank C. Fromherz, C. L. McLemore

Registration
R. A. Hall, *Chairman*

Herman M. Andreas, James W. Braswell, Edmond M. Brignac, Jr., Julius W. Cole, Andrew E. Coppejans, William S. Evans, Egon Lazarus

Student Activities
Frank Dalia, *Chairman*

B. J. Covington, C. H. Edwards, A. J. Szabo, Edward R. Morphy

Women's Activities
Mrs. Frank C. Fromherz, *Chairman*

Mrs. Frederick H. Fox, Mrs. Louis M. Buja, Mrs. Alvin M. Fromherz, Mrs. Frank W. MacDonald

THE READERS WRITE

Nomographic comparison of pipe-flow formulas

To the Editor: In the article, "Pipe-flow Formulas Compared by Nomograph," by Francis S. Y. Lee, in the November issue (vol. p. 796), inspection of the fundamental relations expressed by the various flow formulas quickly reveals that the apparent difference between Eq. 1*a*,

$$h_f = 15.528 f\,(V^2/D)$$

and Eq. 2*a*,

$$h_f = 15.513 f\,(V^2/D)$$

is nothing more than an illusion served up by the calculating machine. This is shown as follows:

By equating the Darcy and Manning formulas (substituting $D/4$ for the hydraulic radius, R), we can express Mr. Lee's Eq. 4 in its exact form:

$$f = \frac{2_g(4^{4/3})}{(1.486)^2}\;\frac{n^2}{D^{1/3}}$$

Similarly, the Darcy formula can be written as

$$h_f = \frac{L}{2_g}\;f\;\frac{V^2}{D}$$

while the Manning formula can be written as

$$h_f = \frac{n^2(4^{4/3})\,L\,V^2}{D^{4/3}\,(1.486)^2}$$

If, in the latter, we now substitute for n^2 its value as given in the exact form of Eq. 4 above, then Mr. Lee's Eq. 2*a* turns out to be precisely the same as his Eq. 1*a* and the elusive 0.1 percent difference (misstated as 1.5 percent in the article) vanishes, as indeed it must, since he has done nothing but solve what mathematicians call an identity.

More important is the fact that this exercise could mislead the designer into believing that the Manning formula is essentially equivalent in usefulness to the Darcy formula.

Armed with the proper value of f (which has been proved to be a function, not only of the boundary roughness, but also of the conduit diameter and the Reynolds number), the Darcy formula becomes a rational and scientific tool. The Manning formula remains what it has been for 70 years—an empirical but dimensionally incorrect relation with relatively limited application except under fully turbulent flow.

Murray D. Lester, M. ASCE
Senior Engr., Aluminum Laboratories Ltd.

Montreal, Canada

Author replies

To the Editor: In reply to M. D. Lester's comments on my article in the November issue (vol. p. 796), I would like to point out:

1. My article makes no attempt to evaluate the numerous pipe formulas. Its

purpose is to introduce a nomographic comparison for evaluating equivalent coefficients in practical pipe-flow design work. In fact, a nomograph is only a graphical representation of an existing mathematical relationship. It does not illustrate any theoretical or experimental development.

2. To the writer's knowledge, the Manning formula is still being employed for the design of concrete pipes and even for excavated horseshoe water conduits, and the Hazen-Williams formula is also being used for the design of cast-iron pipes in water works.

3. Mr. Lester is indeed right in pointing out that a numerical error appears in the comparison of Eq. 1*a* and Eq. 2*a*; the difference of 1.5 percent should read 0.1 percent. The latter figure was approximately computed by substituting Eq. 4, which is rather a simplified expression for the purpose of facilitating the nomographic construction. (It is true that all the formulas will give the same results if possible equivalent coefficients could be used.) However, Eq. 2*a* is only an example, and therefore it does not affect the nomographic presentation for the comparison of different coefficients nor the intended approach of establishing a simplified procedure to evaluate equivalent coefficients.

4. I wish to express my thanks to Mr. Lester for his constructive comments which emphasize the value of f. In fact, f is purposely taken in my article as a primary criterion with particular reference to the relative roughness, K/r_o, of the general resistance diagram for the direct evaluation of the equivalent coefficients such as n or C.

It is hoped that my article will help to simplify much routine calculation in design work, and stimulate further discussion toward a more generalized solution of the problem.

FRANCIS S. Y. LEE, F. ASCE
Ebasco Services Inc.

New York, N. Y.

"The right answer" on uplift in gravity dams

TO THE EDITOR: The writer regrets that he cannot agree with the intended meaning of R. Robinson Rowe's statement in Exam Gems in the October issue, vol. p. 754: "For uplift, authorities do not agree on a right answer, . . ."

My objections focus specifically on the words "authorities do not agree." To quote Roy W. Carlson, "After studying the discussions by J. L. Serafim and Serge Leliavsky, the writer wishes to revise his conclusions regarding pore area subject to uplift. . . . The only known and defensible method for determining the one maximum pore area which exists in a specific concrete, is that of testing to failure, as was done by Leliavsky. . . ."

Mr. Carlson adds, "And the writer agrees with Mr. Leliavsky that the 'weakest section' is the one which should govern." (Roy W. Carlson, Discussion on "Permeability, Pore Pressure and Uplift in Gravity Dams," ASCE *Proceedings*, Aug. 1956, p. 1046-5.)

In the opinion of another authority, Laginha Serafim: "In the tests carried out by Leliavsky the samples were tested up to rupture. . . . The values of the effective area found by this author (mean value 0.91) have, therefore, to be taken into consideration when it is sought to verify the stability of constructions in relation to rupture." (J. L. Serafim, Discussion on "Permeability, Pore Pressure and Uplift in Gravity Dams," ASCE *Proceedings*, Feb. 1956, pp. 904-23, 904-24.)

It follows that informed opinion is not as contradictory as Mr. Rowe suggests.

SERGE LELIAVSKY, F. ASCE
Hydraulic and Structural Engr.

Maadi, Egypt

ENGINEERS' NOTEBOOK

Extra-large bars for reinforced concrete columns

VERNON E. SWANSON, F. ASCE

Structural Engineer

Harza Engineering Company International

Chicago, Ill.

With the "skeleton" look in building architecture and the demands for more usable space per floor, structural engineers are being asked more than ever to cut down column sizes. In reinforced concrete buildings, one method of achieving this is to use concrete of higher strength and reinforcing bars larger in area than the No. 11 size (for ASTM Design A408-57T). At present No. 14 bars (2.25 sq in.) and No. 18 (4.00 sq in.) are being produced in Structural, Intermediate and Hard grades and also in alloy steel (of 75,000-psi yield point). The provisions of ASTM Specifications A-15 and A-305 apply except for height of deformation and testing methods. At present there is no precise knowledge on the bonding properties of these extra-large bars in concrete. Their design bond values are assumed to be somewhat lower than those for conventional sizes.

To avoid lapped splices, the bars can be either butt or thermite welded to meet the ACI requirement that the weld must develop in tension the yield-point stress of the reinforcing steel used. If butt welding is chosen, the end of the lower bar should be given a square saw cut and the upper bar a chisel edge, made with a 45-deg bevel from each side.

One of the construction problems common to any column that has a large cross-sectional area of reinforc-

ing is the placing of beam and slab reinforcing. Where slab reinforcing is small in size and widely spaced, there is no difficulty, but where beam reinforcing of large size must pass through the columns, very accurate setting is necessary.

The positioning of the column verticals should be studied in the preliminary stage and established on large-scale drawings showing all the vertical and horizontal bars that occur at a given level. These details then should be followed through in the design. In many cases the number of beam bars in one layer is limited by the vertical-bar pattern so that two layers, and consequently a different *d*, must be used. It may be that the use of a beam which is wider than the column will allow all bars to be accommodated in one layer.

When the working drawings are prepared, typical column details should be shown to a large scale, and completely dimensioned and oriented, with any notes pertinent to construction. It should be impressed on the contractor, by the use of drawing notes and specifications, that all clearances must be accurately maintained. Beam schedules should be checked against crossing conditions at each column to make sure that the information given is accurate.

On the job, all column verticals should be set and kept in position by templates and spacers, preferably welded to the bars. Splice points should be located sufficiently high above the floor level to provide a comfortable working level for the welder. Where butt welding is used, a splice line arranged so that welding can be done in a sitting position is best. Splicing is generally done at two-story intervals and the problem of supporting a bar, which can weigh 300 lb, for welding is handled by the use of welding clamps grooved to match the bar deformations. While welding is in progress, templates should be used to maintain the bar alignment.

It is useless to issue a well prepared set of column schedules and details when the bars are not set with a corresponding degree of accuracy in the field. Competent field supervision must be provided by the architect or engineer to benefit both himself and the contractor. The supervisor must personally approve the final position of all large bar verticals before concreting. Of course all butt welding should be done by qualified welders and a sample weld submitted for tension testing before job welding begins. After welding of the column has started, each weld should be spot checked and those that appear to be unsound should be radiographed.

Were it possible to waive the ACI requirement for welding strength when the design indicates that the column reinforcing is always in compression, then some very simple and inexpensive connection could be used—by milling the ends of the bars to transmit bearing. One such connector is a pipe sleeve welded to both the top and the bottom bar with a small fillet weld.

The accompanying photos show details of the column reinforcing for the Washington National Insurance Company building in Evanston, Ill. The high-strength reinforcing bars used were Nos. 145 and 185, furnished by Republic Steel Co. The building was designed by Graham, Anderson, Probst & White, architect-engineers, and constructed by the Sherman Olson Corp., contractors, both of Chicago, Ill.

High-strength reinforcing bars in column verticals are electrically butt-welded to caisson dowels near steel Z-piling on Washington National Insurance Company building in Evanston, Ill. To accomplish the weld, the lower bar is given a square-cut end and the upper bar a chisel-cut end. Outer ring consists of eight bars with spiral and inner ring of three bars and ties.

Left: Clamps hold column verticals in position for butt welding at first-floor level. Inspecting clamps is N. F. Brunkow, F. ASCE, Chief Structural Engineer, Graham, Anderson, Probst & White, Chicago, Ill. Right: Column verticals are butt-welded. Splices are placed at a comfortable working level for welders. Bars are Nos. 145 and 185, furnished by Republic Steel Co.

ASCE News

(Continued from page 61)

ASCE and the Future

Engineers attending the recent Sanitary Engineering Division Conference in Cincinnati heard W. H. Wisely, Executive Secretary of the Society, discuss ASCE and the future in a featured address. Two subjects of special concern to members in Mr. Wisely's forward-looking address are excerpted here. Both are under study by Society committees.

Committee Meetings

Of all the major technical societies, ASCE stands alone in subsidizing travel of its committee members to meetings throughout the United States. Our fellow societies—with no arrangements for such committee travel—reimburse only members of their respective Boards of Direction. Mr. Wisely pointed out that the increasing demands for ASCE funds on the part of the more than 300 committees pose a problem of increasing complexity—a problem in serious need of further study and resolution.

Technical Meetings

Shortcomings of the present schedule of three major Conventions a year were also discussed by Mr. Wisely. Engineers, constantly faced with increasing demands on their time, must compare meetings and select those they will attend on the basis of the direct benefits offered to them. Because the Conventions are general in nature, they tend to cover too broad a field of interest. Many papers presented on many subjects also result in conflicts so that an engineer attending a convention often finds himself wishing he could hear more than one speaker at a time.

A possible solution to this problem would be to hold meetings or conferences on the common interest level. Mr. Wisely suggested examples, such as a Water Resources Engineering Conference to be jointly sponsored by the Hydraulics, Irrigation and Drainage, Sanitary Engineering, Power and Waterways and Harbors Divisions; a Transportation Engineering Conference to include the overlapping interests of the Highway, Air Transport, Pipeline, and Waterways and Harbors Divisions; and a Structural Engineering Conference to include participation by the Structural, Engineering Mechanics, and Soil Mechanics and Foundations Divisions. As visualized, these conferences would be held annually, alternating among Eastern, Central and Western locations. Each would offer a program of at least three days' duration, in the same general sessions and some concurrent sessions. Under this plan the winter and spring Conventions would be abandoned and the Annual Convention directed to Society business, Conditions of Practice sessions, and technical papers of general interest.

Mr. Wisely assured the group that the Society is thinking ahead, and he pledged the interest and support of the Society to worthy activity which will strengthen and enhance the usefulness of our Technical Divisions in serving all 44,000 members of ASCE.

ASEE Sponsors Conference on Faculty Development

Increasing the effectiveness of the young college engineering teacher was the prime aim of a recent three-day closed conference on "The Development of Young Engineering Faculties," sponsored by the American Society for Engineering Education's Committee on the Development of Engineering Education. Invited participants included coordinators of the faculty development programs of a number of engineering schools, engineering deans, young engineering teachers, and specialists from such fields as education, psychology and sociology. Case Institute of Technology was host to the conference, which was supported by the Ford Foundation.

The program got under way with a review and analysis of existing programs for developing engineering faculties. The second day was devoted to a study of the potential contributions of other disciplines to the development of the young engineering teacher. And the final session focused on efforts to clarify issues and identify the most promising avenues for further work.

It was the consensus of the conference that most young teachers do not receive genuine guidance during their initial teaching experience, and that it is in this area that the greatest immediate gains can be made. It was also agreed that when orientation programs and seminars on educational matters are properly adapted to the needs of a particular institution, they can be very helpful to young teachers, and it was felt that more engineering schools should consider them. The conference also agreed on the need for additional literature "especially designed to stimulate, challenge, and inform" the young engineering teacher.

The Committee on Development of Engineering Faculties, a three-year-old activity of the ASEE, was formed to study the recruitment, development, and utilization of engineering college faculties in a program of constant improvement. With support from the Ford Foundation, it is completing a nationwide study of successful institutional practices in these areas. The committee's final report will be published in the ASEE *Journal of Engineering Education*.

Engineering College Research Reviewed

Over 10,000 research projects are now underway in 118 leading engineering colleges across the nation, according to the biennial review just published by the Engineering College Research Council of the American Society for Engineering Education. Expenditures on these research activities during the current year will total over $112,000,000.

Dean Kurt F. Wendt, of the College of Engineering at the University of Wisconsin, who is chairman of the Engineering College Research Council, says that these figures are the largest in the fifteen-year history of the ECRC surveys.

The 1959 survey of engineering college research gives complete titles for all projects underway in schools which hold ECRC membership; lists the number of research personnel at each institution; and summarizes research policies. There is a complete index of research project subjects, to help in locating activities in similar fields at different institutions.

Editors of the *1959 Review of Current Research* are Dr. Renato Contini, secretary of the Engineering College Research Council, and a member of the Research Division in the New York University College of Engineering, and Paul T. Bryant, editor of the ASEE *Journal of Engineering Education*.

Copies of the review are available from the Secretary of the American Society for Engineering Education, University of Illinois, Urbana, Ill., at $2.00 each.

Division Doings

Construction Division

Dan Morris, chairman of the Division's Publication Committee, reports that the Division will have three Journals and four Newsletters in the coming fiscal year. He has enough papers reviewed and edited for one Journal, and enough in the mill for another. The Adverse Weather Committee, through Chairman Palmer W. Roberts, is working with the Session Programs Committee to prepare sessions on cold weather for the Boston Convention next fall. Captain Roberts has written to all the ASCE Sections requesting a liaison relationship to give advice on weather conditions in problem areas.

Engineering Mechanics Division

The Division is planning to hold a Conference on Structural Mechanics at Purdue University, Lafayette, Ind., on May 5 and 6. Prof. Bruce Johnston, of the University of Michigan, 1960 program chairman for the Engineering Mechanics Division, is acting for the Division in the scheduling of the papers. The program will include three half-day technical sessions; a tour of the Purdue laboratories; and a joint banquet, on May 5, with the Indiana Section and the Student Chapters at Purdue, Notre Dame, and Rose Polytechnic Institute.

Hydraulics Division

In response to suggestions by the Water Resources Coordinating Committee, the Hydraulics Division plans major revision of its organization in areas dealing with water resources. A change is planned in the stated purpose of the Division to make it consistent with new ideas. Abolishment of the Committee on Hydrology and the establishment of three new committees are recommended. The new committees would be on Hydrometeorology, Surface-Water Hydrology, and Ground-Water Hydrology. To activate this plan, appointment of a water resources coordinator within the Division has been requested.

Soil Mechanics and Foundations Division

The Division is sponsoring a Research Conference on Shear Strength of Cohesive Soils, to be held at the University of Colorado, Boulder, Colo., June 13-17. The general purpose of the conference is to assess the present status of knowledge of the factors governing the shear strength or failure conditions of cohesive soils. Seven technical sessions have been scheduled, five of them to be panel discussions based on preprinted papers. Anyone may submit written discussions of the papers. Engineers interested in attending the conference or in obtaining a copy of the proceedings should write to Dr. J. W. Hilf, Secretary, ASCE Task Committee on Shear Strength of Soils, Building 53, Denver Federal Center, Denver 25, Colo.

The Fifth International Conference on Soil Mechanics and Foundation Engineering is set for Paris, July 17-22, 1961. Several study tours will start out from Paris at the conclusion of the congress. Keen U.S. interest in the congress is evinced by the 55 summaries of proposed papers already received by the Organizing Committee. Unfortunately, as in the case of the Fourth Conference in London, space for only 25 papers has been allocated to the U.S. by the Organizing Committee. Authors of proposed papers will be advised as soon as possible of the status of their papers and the requirements for submitting manuscripts.

Structural Division

The Committee on Electronic Computation of the Structural Division is pleased with the enthusiastic response to its invitation for papers to be presented at the Second Structural Division Conference on Electronic Computation. As previously announced, the conference is to be held at the Pittsburgh Hilton Hotel, Pittsburgh, on September 8 and 9, with the Pittsburgh Section of ASCE as host. Approximately 75 abstracts have been received, covering the fields of structural design and analysis, mathematical methods, and problems of organization, education, program exchange, etc. It is expected that from 25 to 30 papers will be selected for the conference. A review committee has been formed and has already met to go over the abstracts. Final selections will not be made until after the submission of the complete manuscripts which are due April 15.

The committee is looking forward to a successful conference, with an attendance of over 500 engineers.

New EJC Newsletter Due in February

The first issue of Engineers Joint Council's new newspaper, "EJC Engineer," will be published on or about February 15, according to an announcement from EJC. In tabloid size, the new publication will be issued four times during 1960. Myron Weiss, a former department head of *Time,* has been hired as editor.

The newspaper will be distributed to approximately 300,000 engineers, members of the twenty-one engineering organizations that are affiliated with EJC. It will be the organization's first means of direct communication with its constituent society members. EJC recently allocated $15,000 to get the project underway.

The news format of the new publication will be concerned mainly with reporting the activities and actions of the EJC board of direction and its various committees. It will replace the present newsletter (also called the "EJC Engineer"), which has had limited distribution, and EJC's Washington report.

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

City	Current	Previous
Atlanta	1.13	1.13
Baltimore	1.14	1.12
Boston	1.22	1.18
Chicago	1.43	1.36
Denver	1.21	1.21
Houston	1.26	1.26
Kansas City	1.16	1.11
Los Angeles	1.23	1.21
Miami	1.57	1.57
New Orleans	1.18	1.03
New York	1.28	1.25
Pittsburgh	1.04	0.95
Portland (Ore.)	1.25	1.16
San Francisco	1.24	1.24
Seattle	1.06	1.06

Highway Departments

Region	Current	Previous
I, New England	0.90	0.92
II, Mid Atlantic	1.14	1.13
III, Mid West	1.22	1.16
IV, South	1.14	1.08
V, West	1.03	1.02
VI, Far West	1.13	1.11

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current salary total for ASCE Grades I, II and III by an arbitrary base. The base used is $15,930. This is the total of salaries paid in 1956 for the equivalent Federal Grades GS5, GS7 and GS9. Only the annual base entrance salaries are used in these calculations. Index figures are adjusted semiannually and published monthly in CIVIL ENGINEERING. Latest survey was July 31, 1959.

ASCE Convention, March 7-11

Program, New Orleans Convention, Page 75

Canal Street, the widest "main" street in the United States, divides the old city from the new, modern city.

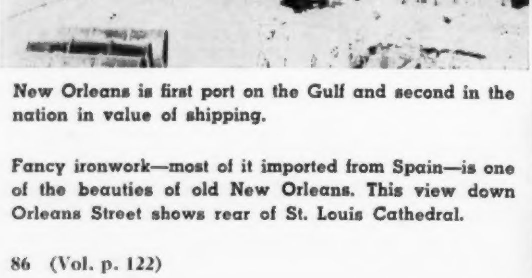
Come

View looking up Chartres Street shows St. Louis Cathedral, in the center, and the Cabildo, on its left, where transfer of the Louisiana Territory from France took place in 1803.

to

All eight major railroads serving New Orleans now terminate in this new $16,000,000 Union Passenger Terminal.

New



New Orleans is first port on the Gulf and second in the nation in value of shipping.

Orleans

Fancy ironwork—most of it imported from Spain—is one of the beauties of old New Orleans. This view down Orleans Street shows rear of St. Louis Cathedral.

Washington Comment on the Budget

President Eisenhower's budget message to the Congress was considered to be non-controversial in most areas. The $84 billion budget for the fiscal year 1961 promised a little something for almost everybody. It made some concessions to the realities of a Democratic-controlled Congress and election-year politics.

Chief among the concessions was approval of 52 new public works starts, for a modest initial total of $38 million (but a final cost, the President was careful to point out, of $496 million)—a near-record request for construction funds for all purposes.

There are a couple of small-sized bombs hidden in the sections covering construction activities. These are in recommended appropriations for the Department of Health, Education and Welfare, and they represent—through cutbacks in requested appropriations—direct challenges to Congress on issues of waste treatment plants, aid to education and other matters, direct challenges to plans already afoot in Congressional circles to boost spending in those areas.

Grants for waste treatment works construction would be cut to $20 million, from $45 million in fiscal 1960 (and $50 million authorized by Congress); grants for hospital construction would be cut to $126.2 million, against $186.2 million in 1960; grants for construction of health research facilities would drop to $25 million, from $30 million; grants for assistance to schools (including construction) in federally affected areas would drop to $171.1 million, from $225.1 million.

As of the moment that the President was delivering his budget message, January 18, a Congressional conference committee was planning to hold its first session to consider versions of bills passed last session that would boost grants for treatment plant construction to $80 million or $100 million a year. The other areas of cuts are also in direct opposition to many Congressional expressions of sentiment.

The total sought for all construction purposes, both military and civil, is a staggering $6.9 billion. That is an all-time record, except for the estimated expenditures of $7.3 billion for fiscal 1960. Most of the drop for 1961 is accounted for by two items: A cut of about $297 million in spending for federal-aid highways, due to strictures on the Highway Trust fund, and a cut of about $300 million in military construction, credited to the near-completion of many military bases, and the changeover to missiles and mobile forces.

Nevertheless, the budget includes a record total—$1.2 billion—for the Corps of Engineers and the Bureau of Reclamation (and other agencies) for water and natural resources conservation. That is up $152 million.

Of course, the overall prediction of roughly a $4.2 billion surplus was tied to two major items, one of which concerns construction, but neither of which is given much chance in Congress. One of these is a further increase of a half-cent in federal gasoline taxes for the highway fund, the other an added one cent on first-class postage.

With all this in mind, then, here are the principal requests for construction money:

Highways, $2.7 billion, down $297 million (This money comes out of the trust fund, so is actually not an appropriation item.)

Army Civil Works, $770 million, up 77 million.

Military and other national security construction (including Atomic Energy Commission), $1.4 billion, down about $279 million.

Bureau of Reclamation, $241 million, up $61 million.

Federal Aviation Agency, $190 million, a rise of $69.7 million.

Veterans Administration, $75 million, a rise of $15 million.

Postoffice, $90.5 million, up $29 million.

In reading over the reports on the budget message, engineers in particular should note the emphasis placed by the Administration on what it has chosen to call "uncontrollable" items—built-in expenditures such as grants-in-aid for construction, as well as payments to veterans and the interest on the public debt. Examples in construction quoted by the President included the fact that, although he is asking only the amount listed here for the 1961 fiscal year, the total required to complete the projects this will cover will actually be an additional $3.4 billion. The Bureau of Reclamation will need additional funds of $1.3 billion to complete going work; the Tennessee Valley Authority, $247.7 million.

Emphasis on these figures—in addition to the requirements of federal bookkeeping—would indicate continued pressure by the President this year to hold down such future commitments of federal expenditures, on the ground that if the "uncontrollables" keep getting written into law, the whole federal budget becomes a mammoth (1,100-page) bookkeeping farce.

Demand for Engineers Rises, Says EMC

Industrial recruiting and the overall demand for engineers increased materially in 1959, according to the Engineering Manpower Commission of Engineers Joint Council. In its recently issued Ninth Annual Report, EMC reports that acute numerical shortages were not widespread because of the large number of engineering graduates available for immediate employment. In 1959 there were 38,162 B.S. graduates in engineering, the largest class since 1951. It was 36 percent greater than in 1956 and 41 percent over 1955, the period in which shortage was most acute.

The demand for engineering graduates is expected to increase, and by 1966 there will be 15 graduates recruited for every 10 hired in 1959. Starting salaries are at an all-time high, averaging $510 monthly for B.S. graduates, $600 for M.S. graduates and $825 for Ph.D.'s. The aircraft, electrical equipment and electronics industries offered the highest salaries.

According to the report, entitled "Demand for Engineers—1959," the downward trend in the demand by industry and government for engineers has been sharply reversed from that prevailing in 1958, when there was a close supply-demand balance. This, however, was due to the temporary recession in the economy and did not affect the overall demand for engineers, which is growing over the years with the expanding economy.

The report warns that, as the economy continues to expand, numerical shortages of engineers again may be present because recent engineering school enrollments have declined.

Since 1951 the Engineering Manpower Commission has conducted annual surveys of trends in the demand for engineering graduates in industry and government. The present report is available from the Commission, 29 West 39th Street, New York 18, N.Y.

ASCE Membership as of January 8, 1960

Fellows	10,928
Members	15,716
Associate Members	17,810
Affiliates	92
Honorary Members	47
Total	44,593
(January 9, 1959	41,967)

The Younger Viewpoint

This month's editor is Albert Nelson, who represents Zone II.

Professional Engineering

The Younger Viewpoint concerning professional engineering registration—prepared by Donald Kowtko for the December issue—has evoked the following significant comment from A. W. Crowder, A.M. ASCE, of Miami, Fla.:

"Are the seal and signature of the "Registered Engineer" becoming a "means" rather than an "end"? In this present day and age, due to laws that exist, most plans and specifications require the above-mentioned seal and signature. To obtain this equipment, the engineer must take what is known as a professional registration examination. This examination is comprised, in the main, of problems—problems particularly in the field of design. Yet, how many engineers engaged in private practice have the opportunity to really "design" in the pure concept of the word? We are hedged in on one side by strict governmental agency rules for design, which may actually include formulas and methods that must be used to comply with these agencies' desires. In some cases these rules have been established by persons of somewhat less than professional standing. Does it take a registered professional engineer to go through the mechanics of plugging in these "design" formulas? No! But it takes, by another stipulation of the same agencies, a registered engineer's seal before it can be accepted. If this is the case, of what advantage was the professional registration examination?

"The registered professional engineer is a responsible man dedicated to ethical practice and desirous of utilizing the knowledge and experience at his command to design more economically and practically. How many engineers have this unrestricted opportunity? Usually somewhere along the way he has been restricted by some agency, which actually dictates, 'You will do things our way, whether it is the most economical, practical design or not.' If the engineer does not comply, his plans are refused by the agency. This stumbling block occurs in the majority of cases and extends into practically every field of design.

"If the engineer attempts to present the case for his design as opposed to the "canned" design specified, he soon finds this to be time consuming and costly, and his client may not be inclined to such a noble cause at the expense of time and money.

"The question then arises, 'If the engineer is registered and thereby ethically bound to the principles of his profession, can he allow a design which he knows and can prove is inferior to his to bear his seal? Is this the zenith of our profession'.

"If this occurs and we all know that it does, then why not have an examination on the rules and regulations of the various agencies. This would be more of a barometer for 'professionalism' as it now appears to exist."

Food for thought from Mr. Crowder!

Unions For Surveyors?

In the Miami area, there is an Adult Vocational Class in Surveying. This is part of an Evening Trade Extension Course Program of the Florida School Board, mainly comprised of party chiefs, instrumentmen, and rodmen.

Recently, one of the party chiefs enrolled in the class asked what the rest of the class, and the instructor, thought of a union for surveying personnel. He pointed out that he, as a party chief, was making (per hour) less than a carpenter's helper, or steel worker. Yet, those familiar with the surveying profession realize that a party chief and his party have a good deal of responsibility resting upon their shoulders—perhaps even more than the aforementioned carpenters and steelworkers.

First, the party chief's claim of low wages (as compared with other building and construction "trades") was verified by other members of the class. Those familiar with surveying realize that the party chief and his party are the field representatives of the Registered Land Surveyor. As such, the work they do must be done thoroughly and well since many dollars worth of construction may be placed upon the land that they are surveying. If the work is improperly done, the surveyor could become liable for a great deal of money. It was agreed that this, in general, was true.

Second, on the part of the employer, it was pointed out that he has an uphill battle for business. Due to a background of poor salesmanship, people still feel that a surveyor's work is unnecessary and can be done by the individual himself. In fact, if it was not specifically covered by law, many people would do their own surveying. So even in these times, the surveyor has a difficult time getting his asking price for a survey.

The class then endeavored to take the evidence before them and see what sort of result could be arrived at as a course of action.

A union that would say you cannot pay this man less than such and such a wage would be desirable from the workingman's viewpoint. "Collective bargaining" would certainly be an advantage. With the employees supporting this union wholeheartedly, a standard wage could be obtained. These are certainly good features. If these were incorporated, then the employer would be forced to ask his already restless clients for higher prices on surveys, and there is a good chance that the client would forego his survey unless it was absolutely necessary. When this was elucidated to the class, it was further mentioned that what the surveying and engineering profession needs is concerted *public relations work,* not only on the part of the registered man, but on the part of his employees as well. It was thus decided that a union dedicated to two purposes—first, the reasonable well being of its members and second, the general promotion of the surveying profession—would be desirable.

There is a lot to think about here. Some of it may be right, and some of it may be wrong. What do you think? As the younger member becomes more active in the profession, and more younger members start into business for themselves, the discussion just featured may become a familiar one.

Committee on Younger Member Publications

Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 289 Foxhill Road Denville, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	Walter D. Linzing 4751 No. Paulina Chicago 40, Ill.	Judd Hull 3178 Almeria San Pedro, Calif.

ASCE CONVENTIONS

NEW ORLEANS CONVENTION

New Orleans, La.
Jung Hotel
March 7-11, 1960

RENO CONVENTION

Reno, Nev.
June 20-24, 1960

ANNUAL CONVENTION

Boston, Mass.
Hotel Statler
October 10-14, 1960

NUCLEAR CONGRESS

New York, N. Y.
Coliseum
April 3-8, 1960

Program Manager

ASCE

DISTRICT CONFERENCES

DISTRICT 9 COUNCIL

Columbus, Ohio
April 29-30, 1960

Hosts

Central Ohio Section

PACIFIC NORTHWEST COUNCIL

Tacoma, Wash.
April 22-23, 1960

Hosts

Tacoma Section

TECHINICAL DIVISION MEETINGS

RESEARCH CONFERENCE ON SHEAR STRENGTH OF COHESIVE SOILS

Boulder, Colo.
University of Colorado
June 13-17, 1960

Sponsored by

Soil Mechanics and Foundation Division

HYDRAULIC CONFERENCE

Seattle, Wash.
University of Washington
August 17-19, 1960

Sponsored by

Hydraulics Division

CONFERENCE ON ELECTRONIC COMPUTATION

Pittsburgh, Pa.
Hilton Hotel
September 8-9, 1960

Sponsored by

Structural Division

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

The **Alaska Section** has reactivated its newsletter, *The Alaska Engineer*. Action along this line was taken at the Section's recent annual meeting. At the same meeting officers for the coming year were elected. They are Elbert F. Rice, Jr., president; Wesley H. Butler, first vice-president; John D. Argetsinger, second vice-president; John R. Watson, Jr., secretary; and Charles E. Clark, treasurer.

Those attending the recent annual meeting of the **Central Illinois Section** heard guest speaker Linton Hart, district engineer for Raymond International, Inc., in Detroit, Mich., relate his experiences in foundation engineering, especially the causes of foundation failures. Next on the program was the installation of the Section's 1960 officers. C. E. Kesler is the new president; H. O. Scheer, first vice-president; W. J. Roberts, second vice-president; and J. D. Haltiwanger, secretary-treasurer.

Members of the **Georgia Section** had a most successful annual meeting, the forty-seventh one, on December 5. The technical sessions and luncheon were held at the Architectural and Engineering Institute in Atlanta, and the evening dinner-dance was held at the Atlanta Biltmore Hotel. Maj. Gen. Albrecht, of the Corps of Engineers, delivered an excellent keynote address at the morning session on the future for the engineer. Gen. Albrecht said that the U. S., and eventually the whole world will become so dependent upon technical advancement that it will be in some ways an engineer's world. Concluding the morning's activities, ASCE President Frank Marston spoke on the United Engineering Building and outlined the breakdown of space allotments within the building. Illustrating his talk were a number of slides on the ground breaking ceremonies held recently in New York. In the evening the usual installation of officers took place. They include Lewis A. Young as president; Col. Fred L. Ackerson as vice-president; and Charles F. Trainor as vice-president at large. Arthur S. Booth is resident director; Joel K. Haugan, non-resident director; and James R. Fincher, director associate member. . . The high point of the December 2 meeting of the **Savannah Branch** was the election of officers—James R. Marble as president; Herbert M. Barnum as vice-president; and William R. Smith as secretary.

Keith K. Wallace has been selected by the **Hawaii Section** as Engineer of the Month. A civil structural engineer with the Hawaii Board of Water Supply, Mr. Wallace is also chairman of the Legis-

The Central Ohio Section held installation exercises for its 1960 officers at a luncheon meeting on December 17. Pictured here are Stanley P. Belonos, secretary-treasurer; Harry H. Hawley, first vice-president; O. H. Jeffers, past-president; Harold A. Bolz, dean of the College of Engineering at Ohio State University, who addressed the group on how to get the most out of technical society membership; Robert F. Baker, president; and S. W. Dudley, second vice-president.

Joe E. Johnson (second from right), senior in civil engineering at the University of Kentucky, receives a $250 Kentucky Section Scholarship for the 1959-1960 school year from Milton Evans, Jr. (second from left), Junior Contact Member for the Student Chapter. Looking on are David K. Blythe (left), Section secretary-treasurer, and Ramon E. Ward (right), president of the Student Chapter. George Herlig (not shown), of the University of Louisville, also received a scholarship from the Section.

Lawrence A. Elsener (left), Zone IV, vice-president, hands a letter from ASCE President Frank A. Marston to Hawaii Section past president, Edward J. Morgan, center, while Wayne E. Duncan, Section president, looks on. The letter salutes the Hawaii Section as one of the honor Sections in the Fund Drive for the United Engineering Center.

ASCE President Frank Marston (second from right) congratulates John T. Dennison the new president of the Nashville Section. Other new officers are (left to right) Robert L. Whitaker, secretary-treasurer, and Prof. Cecil A. DeVilbiss, vice-president.

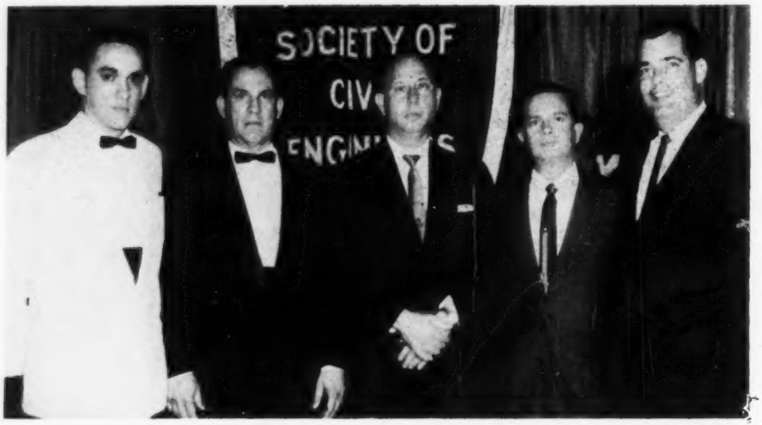
lative Committee of ASCE and the Hawaii Society of Professional Engineers.

The **Illinois Section** recently held a fine annual meeting with the presentation of Life Membership Certificates and the installation of new officers as two highlights. The new life members are Cyrus Remington Bird, Charles Walter Bryan, Jr., Elrod Everett Cress, Peter Christensen Hammelef, Cecil John McLean, Thomas H. Rust, Edwin Batty Styles, Calvin Victor Davis, Thorbjorn Germundsson, Gene Bryant Heywood, and Andrew Nelson Wardle. Elected to serve the Section for 1960 were John G. Hendrickson, Jr., as president; Robert Hall as vice-president; and Donald Walsh as secretary. Directors are William R. Walker, Jr., for one year, and E. I. Fiesenheiser, George Reynertson and Sven Johnson, each for two years.

Edward M. Cummings was named president of the **Lehigh Valley Section,** at the group's annual dinner meeting on December 14. Other officers named were William Strobel, first vice-president and Jackson L. Durkee, second vice-president. In his first official act, Mr. Cummings presented a certificate of appreciation to out-going president John M. Adams. Also given a certificate for his services was E. Leland Durkee, District 4 Director. Life Membership Certificates were presented to Lyle M. Entrekin, John Farenwald, and C. Radford Berry.

Delmer C. Dean, structural engineer with the Oklahoma City consulting engineering firm of the Benham Engineering Company, has been elected chairman of the **Oklahoma City Branch** of the **Oklahoma Section** for 1960. Elected to serve with him are Gerald Emerson, vice-chairman, and Howard L. Russell, secretary-treasurer.

Guest speaker at the December meeting of the Section's **Tulsa Branch** was Dr. Clark A. Dunn, director of engineering research at Oklahoma State University and past president of the Oklahoma Section. Dr. Dunn gave an illustrated talk on his observations of Air Force installations in Greenland, Alaska and Northern Canada.



New Board of Directors of the Puerto Rico Section was introduced to a distinguished group of members and guests at the Section's final meeting of the 1959 season. Pictured, in usual order, are Juan R. Figueroa, second vice-president; Hector A. Deliz, president; Fernando Torrent, first vice-president; Antonio R. Torres, past president; and Efrahim Murati, secretary-treasurer.

Major-General Louis W. Prentiss (standing), executive vice-president of the American Road Builders Association, chats with Cadet E. C. Emerson, president of the Student Chapter of the Virginia Military Institute and winner of the Virginia Section's award for the outstanding student paper from all of the engineering schools in the state. General Prentiss spoke at the annual banquet on the cost-benefit ratio of the Interstate highway system.

Celebrating the tenth anniversary of the founding of the Mexico Section at a recent dinner-meeting are, left to right, Hector M. Calderon, past president of the Section; Teodoro Shumacher, secretary of the Colegio de Ingenieros Civiles de Mexico; Francisco Aubert, president of the Mexico Section of AIEE; Lorenzo Perez Castro, ASCE Honorary Member; Lawrence A. Elsener, Zone IV Vice-President; Miguel Montes de Oca, Section president; Humberto J. Benet, Section secretary-treasurer; and Lawrence Zoller, president of the Mexico Section of ASME.

The **Spokane Section** held its annual meeting on December 12. The two-part session—an afternoon technical session and an evening dinner and social meeting —was attended by 70 members and guests. Don Stein, district engineer with the Washington State Highway Department, spoke on the new freeway through Spokane; Prof. Leon Luck, of Washington State University, on the electronic computer in engineering; and Cliff J. Okeson, regional geologist with the U. S. Bureau of Reclamation, illustrated his talk on earthquakes with demonstrations of vibration phenomena. The Section awarded an Engineer of Merit certificate to W. L. Malony for his distinguished service to the profession in general and the Spokane Section in particular.

The **St. Louis Section** was introduced to its new president, Erwin E. Bloss (see photo), at its annual meeting held on December 4. Also present were R. Earl Salveter, the Section's new first vice-president; Ralph L. Eason, second vice-president; Irwin A. Benjamin, secretary; and O. Fred Nelson, treasurer. The speaker was Leonard Hall, noted author and columnist, on the beauty and philosophy of outdoor living, especially in the Ozark country.

The official slate of officers for the **Wisconsin Section** were introduced at the Section's annual meeting on December 17. They are Henry B. Wildschut, president; Edward A. Korpady, first vice-president; Eldon C. Wagner, second vice-president; and Donald D. Roethig, secretary-treasurer. Those attending the meeting also met the new officers of the Structural Committee. Robert E. Schloemer is the chairman; Robert W. Kuech, vice chairman; and Leonard P. Anhalt, secretary-treasurer. At the dinner-meeting preceding the annual meeting Life Memberships were presented to Carl A. R. Distelhorst, G. E. Hill and M. C. Steuber.

LOCAL SECTION MEETINGS

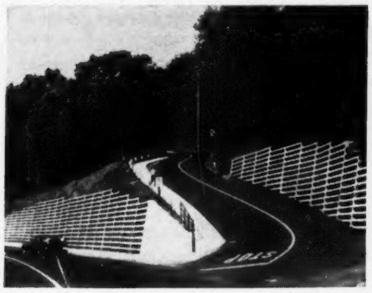
Illinois—Weekly luncheon meetings at the Engineers' Club, Chicago, every Friday, at 12 noon.

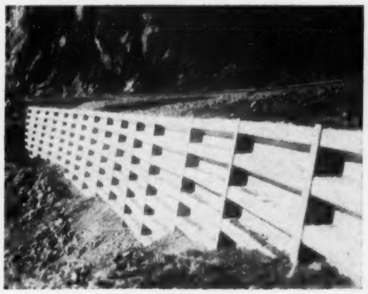
Intermountain—Regular monthly meeting on the fourth Friday of each month.

Metropolitan—Regular monthly meeting in the Engineering Societies Building on February 17, at 7:00 p.m.

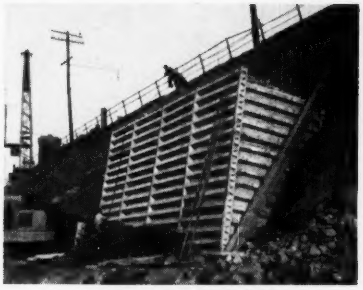
Sacramento—Weekly meeting at the Elks Temple every Tuesday, at 12 noon.

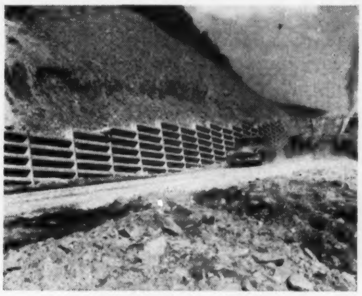
Texas—Spring meeting in Midland, Tex., April 21-23.


Approach Highways?

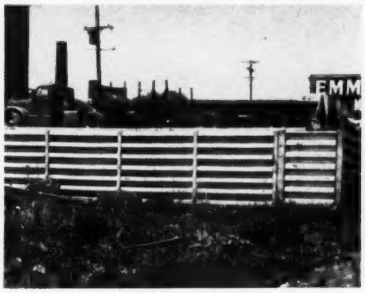

Stabilize Slope?

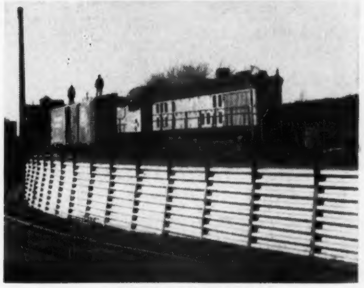

Stream Erosion?

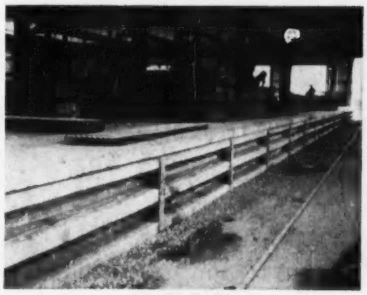

Replacing Existing Wall?


Holding Back Slope?


Bridge Wing Walls?


Gain Parking Area?


Elevated Railroad?


Loading Dock?

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BY-LINE WASHINGTON . . . . .

Civil engineers should become aware of a serious—if as yet apparently unorganized—campaign being mounted against them out of Washington, in connection with the **Interstate Highway Program.** Some very respectable names, including the Controller-General of the United States and Senator Harry F. Byrd of Virginia, are now getting attached to the criticisms.

You will recall the start of this particular campaign as a report on the highway program, published by the General Accounting Office near the end of the last session of Congress (CIVIL ENGINEERING for August, page 94). In that report, the GAO was critical of contracts let by the state highway departments to engineers and architects, *where the fee is normally a percentage of the total cost.* This practice, said GAO, offers at least the temptation for engineers to design as expensively as possible, to increase their own fees.

The next shot came in the publication of an exchange of letters between Senator Byrd—the Senate's most respected financial specialist—and Secretary of Commerce Frederick H. Mueller. After reiterating his opposition to continued special taxes for highways and to running the program beyond the means of the Highway Trust Fund, Senator Byrd added, "Highway engineers generally are highly competent. . . . But there is a temptation to regard the . . . interstate program as a windfall and a license to go all-out with dream designs without limit on expense. . . ."

And in December, the **GAO fired off another blast**—this time scoring the State of Maryland for "wasting federal money by hiring consultants to do the work that should have been done by staff engineers." Maryland State Highway Engineer Norman L. Pritchett—backed by his Highway Commission—stoutly defended the state's expenditures of about $27 million since 1954 for consultant fees. He commented that the state has been unable to fill staff engineering vacancies, could not have done as much as has been accomplished without consultants, has spent less than 10 percent of total road money in buying outside engineering services, and will continue to use consultants in the future. (The state took on no consultants for nearly the full year of 1959, because of uncertainties in obtaining federal aid money.)

In this connection, it might also be noted that there were some comments on Congressional floors last session, concerning **engineer and architect fees on public buildings** as well as on highways. Just what is powering the attack at present isn't too clear. Best guesses you can get in Washington put it as (1) desire to make a show of saving money, and (2) general lack of understanding of engineers' insistence on negotiation, rather than bidding, on public construction work.

* * *

The trend of any new **water conservation legislation** can be seen by reading the transcripts of the hearings held so far by the Senate's Select Committee on National Water Resources. They run this way: (1) A federal loan program to aid municipalities in building water supply facilities; (2) changes in present laws to permit consideration of recreational and fish and wildlife conservation advantages of multi-purpose river developments; (3) strong support for expanded federal aid to communities for stream pollution abatement. These ideas are worth your attention—the committee membership, under Oklahoma's Bob Kerr, swings a lot of weight in the Senate.

* * *

Although the prospects of any **meaningful school-aid legislation** are still considered slim at this session (see the January column), the Administration has moved strongly to stake out a position in favor of such aid, for the benefit of the record, at least. Health, Education and Welfare Commissioner Flemming was spokesman, pointing to a nationwide deficit of some 132,400 classroom units. Mr. Flemming's statement bore some promise for construction however. It noted increasing voter acceptance of bond issues to finance school construction.

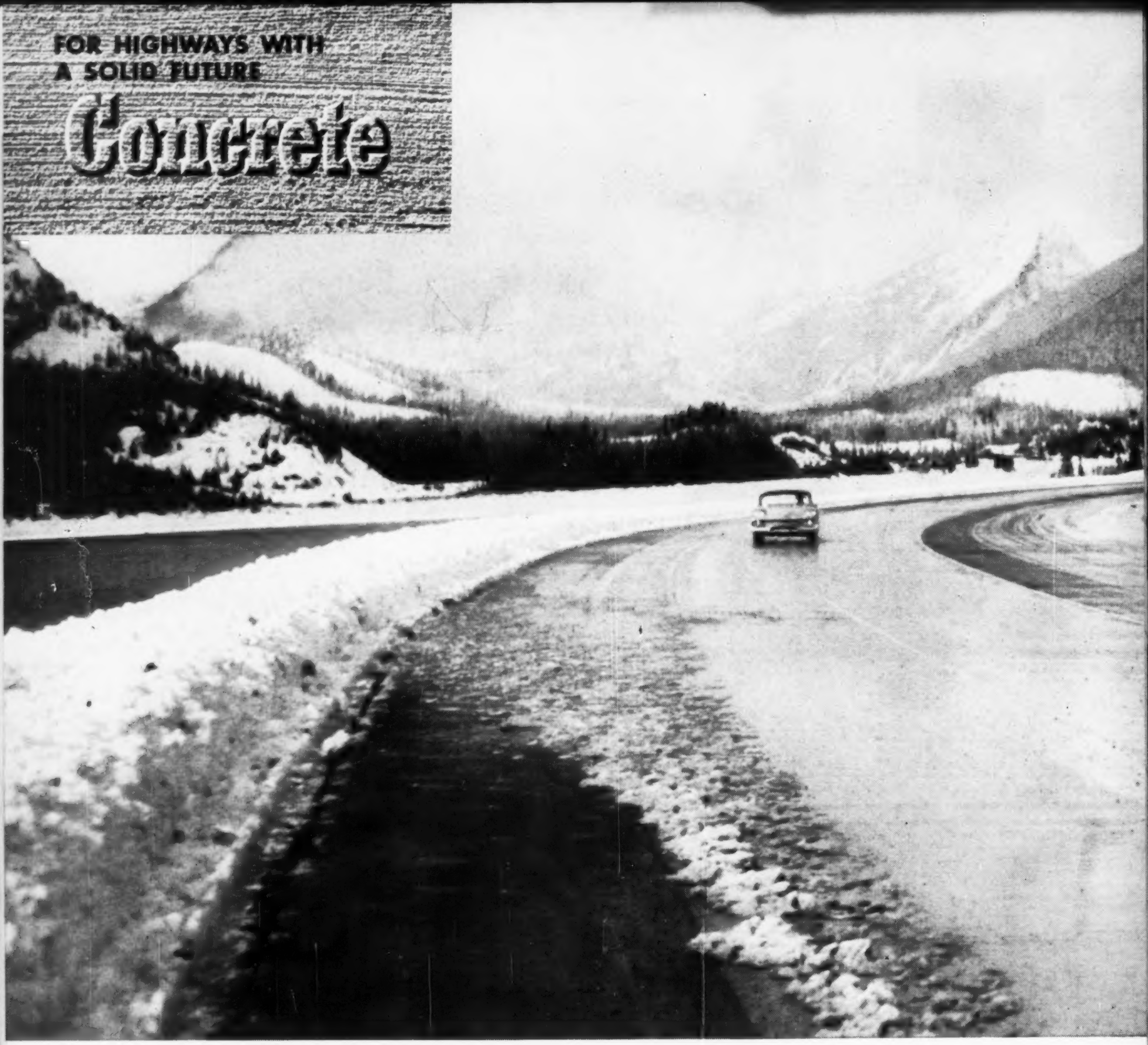
* * *

Soviet ideas for building a dam from Siberia to Alaska, equipped with pumping stations to draw cold Arctic water into the Pacific, and permit the Gulf Stream to flow through the Arctic, are getting a hearing (but little else, for the minute) in Washington. Soviet Engineer Pyotr Borisov made the proposal recently, and Alaska's two senators (along with Governor William A. Egan), immediately asked Washington to "explore" the possibilities. Said Secretary of State Christian Herter (in a letter reply to Egan), An immediate, thorough study will be made; the plan has a number of points of great interest to the U. S., but also would involve many complex problems which must be studied carefully.

* * *

Private industry is beginning to use a Budget Bureau directive **against government operations in commercial areas,** as a starting point toward obtaining a larger share of control over production of power from atomic sources. Private power companies, it is said, now want the Atomic Energy Commission to stop competing with private firms in the manufacture of fuel elements; want reactor research and development work now done in AEC laboratories; also want the right to patents on developments made under government contracts. AEC is listening, too: It recently narrowed its reactor research to eight reactor concepts, will spend $1 billion on this job (with private contractors) over the next ten years. If it results in medium-sized prototypes, these will at least be licensed for private use and further development.

[*Editor's Note:* Our Washington correspondent comments on the Presidents' Budget on page 87.]



For Snoqualmie Pass, ...the only pavement with the built-in

High in the Cascade Mountains of Washington, new Interstate 90 year in and year out must face the toughest punishment weather can give.

Snows are heavy in Snoqualmie Pass. 30 feet a year isn't unusual. For 5 months a year, it takes the biggest, heaviest snow removal equipment to keep the road passable.

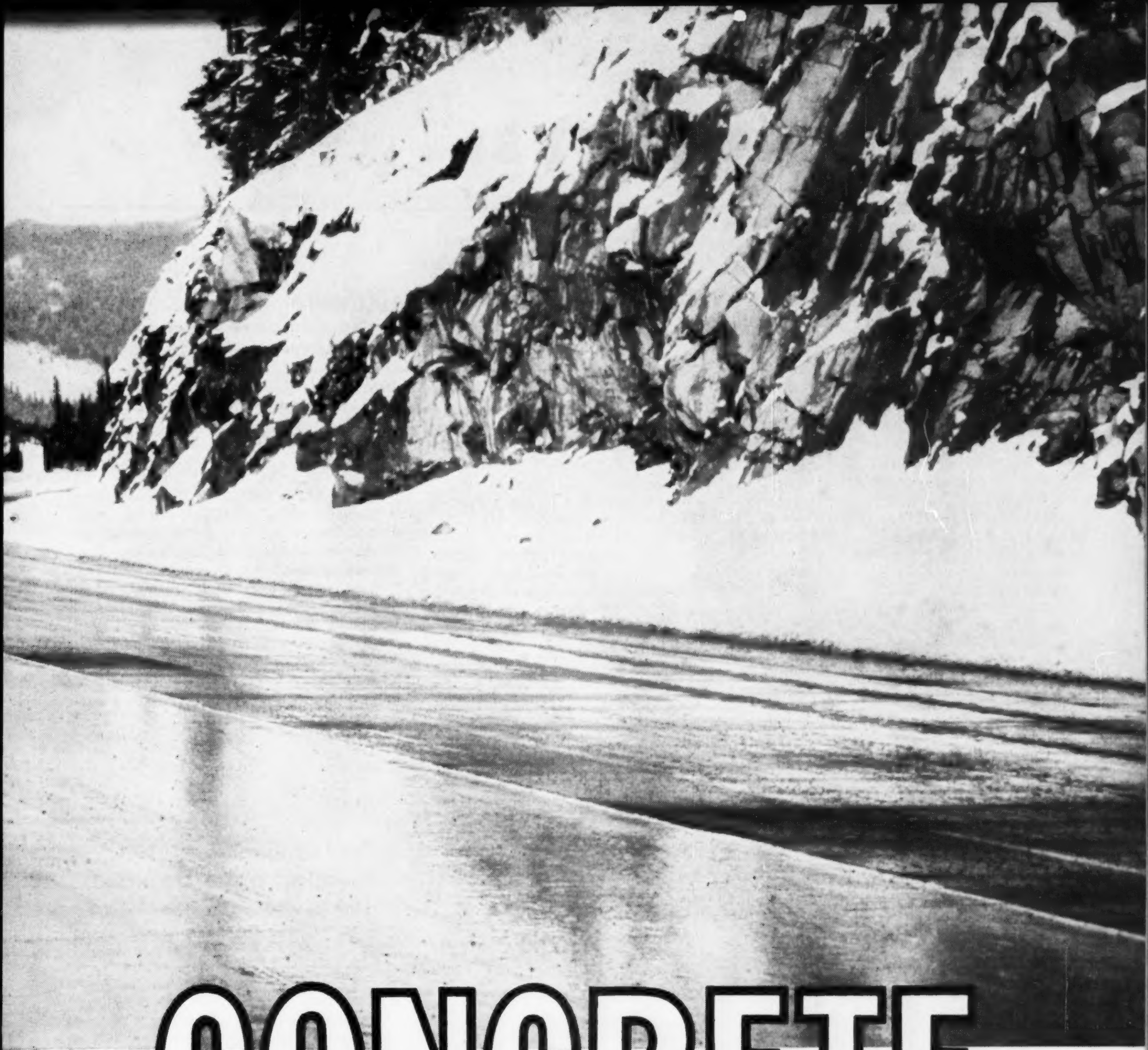
Traffic is plentiful and, when the road is posted, every car uses chains designed to take a deep bite. This is really tough on the road surface, but concrete is meeting every test.

As a special safeguard, bubbles by the billions (air entrainment) have been put into this concrete. And through the ups and downs of temperature and repeated freezing and thawing, the surface is kept free of any scaling or break-up. Even tons of de-icing chemicals can't cause harm.

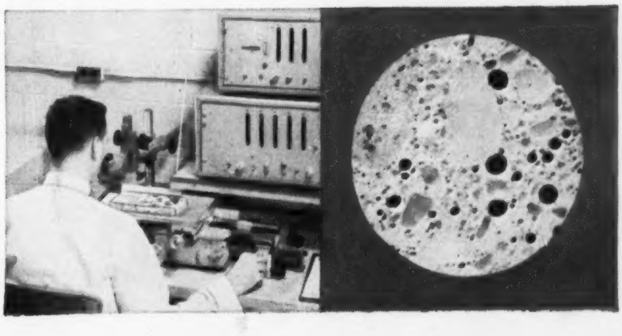
Here's a perfect example of the *stability* found in concrete under the most difficult and extreme conditions. One more reason why you're seeing so many new concrete highways. They are stretching out mile after mile on Interstate and other heavy-duty routes everywhere.

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete



it's CONCRETE protection against weather damage



Checking bubbles by the billions, the *air void analyzer* gives engineers an electronic control on air entrainment. Some 5 million bubbles per cubic inch of concrete (magnified specimen at right) give freezing moisture the room to expand.

NEWS BRIEFS . . .

Construction Volume at New High in 1959

Contruction volume in 1959 registered its greatest annual increase in ten years, climbing to a total of $73 billion, the Associated General Contractors of America stated in its annual year-end review and outlook statement. As the AGC sees it, prospects are bright for another record-breaking year in 1960.

The 1959 total—consisting of $54 billion in new construction put in place and an estimated $19 billion in maintenance and repair operations—was sparked by a sharp increase in residential volume and moderate rises in most other major types of construction.

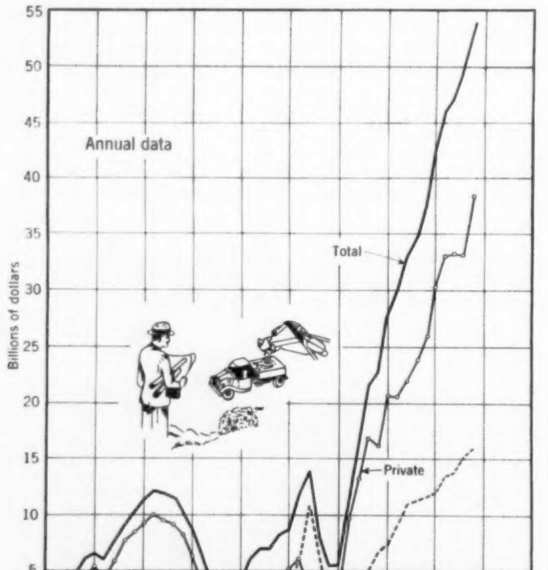
As the nation's largest production activity, construction broke dollar-volume records for the fourteenth successive year, continuing to account for more than 15 percent of the gross national product, and for some 15 percent of the total employment, directly and indirectly.

Construction volume in 1959 represented an increase of 11 percent over the 1958 total for the largest year-to-year rise since 1950, considerably exceeding most forecasts made at the beginning of the year.

Private construction, propelled by a spectacular spurt in residential activity, rose 13 percent to $37.8 billion, reversing a four-year trend when private construction as a whole had about leveled off. Nonresidential private building remained near the 1958 level at $8.6 billion, with rises in commercial, religious, and social and recreational construction offsetting a continued decline in industrial building. Public utilities, a mainstay in private construction, remained stable at the high level of $5.1 billion. Public construction rose 5 percent to $16.2 billion in 1959, with most major categories sharing in the increase. Highway construction, the largest single category of public works, increased 5 percent to $5.8 billion, although its momentum was slowed by the crisis in financing the long-range federal-aid program.

Other state and local public works, such as sewer and water facilities, hospitals, public service enterprises and administrative buildings, showed moderate increases. Educational building, however, declined 7 percent to $2.7 billion in the face of a continuing shortage of classrooms.

In the programs financed principally by the federal government, military construction increased 6 percent to $1.5 billion, and conservation and development facilities rose 13 percent to nearly $1.2 billion.



Construction activity for 1959 breaks dollar - volume record for the fourteenth consecutive year with total outlays of $54.3 billion for new construction—an increase of 11 percent over the record $48.9 billion spent in 1958. Last year also saw some $19 billion spent for maintenance and repair work.

Forecast for 1960

A total of more than $76 billion is forecast for 1960, depending on various factors. This estimate allows for $56.1 billion in new construction and about $20 billion in maintenance and repair. It does not include work in the new states of Alaska and Hawaii, or overseas construction performed by the U. S. government and private enterprises.

The AGC represents 7,400 leading construction firms in all parts of the country. Its outlook is based on official government figures and information from authoritative private sources. The forecast assumes that costs will not rise appreciably, that materials will be plentiful, that there will be no prolonged work stoppages in basic industries, and that investment in construction will not be seriously retarded in the increasing competition for capital in the tight money market.

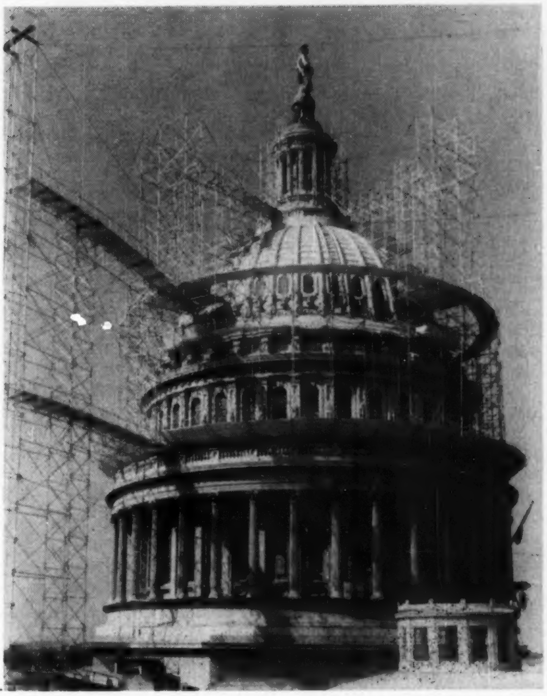
Third Conference on Biological Waste Treatment

Recent advances in biological oxidation and oxygen transfer in the disposal of waste from industry and municipalities will be featured on the program of the Third Conference on Biological Waste Treatment, to be held at Manhattan College, April 20-22. International in scope and the only meeting of its kind in the United States, the conference is expected to attract over 300 from the fields of education, industry, and government. The 45 technical papers will include ten from foreign countries—England, Germany, Holland, Sweden and Japan.

The conference is being made possible by a grant from the Department of Health, Education and Welfare. Conference chairman is W. Wesley Eckenfelder, M. ASCE, associate professor of civil engineering at Manhattan College. Assisting him are Brother Joseph McCabe, F. ASCE, head of the civil engineering department, and Donald J. O'Connor, A.M. ASCE., associate professor of civil engineering.

Professor Eckenfelder stresses the fact that preregistration will be necessary since preprints of all papers will be distributed to participants several weeks in advance of the conference. Conference proceedings, including the discussion, will be published after the meeting. Those wishing accommodations in campus dormitories should lose no time in getting in touch with Professor Eckenfelder at Manhattan College, New York 71, N. Y.

Unique Scaffolding Speeds Repair of Capitol Dome



Close-up of the 180-ft U.S. Capitol Dome, currently undergoing cleaning and repair, shows the network of scaffolding especially developed for the project. Since the capacity of the 100-year-old dome to support any weight is uncertain, Capitol Architect J. George Stewart instructed contractors to keep all weight off the dome itself during the work. To meet this request, engineers from the Universal Manufacturing Corp., Zelienpole, Pa., designed and erected a scaffolding at four equidistant points around the dome. From the top of each of these points trusses were connected to the cupola atop the dome. Galvanized pipe and clamp scaffolding suspended from the trusses permit workmen to reach the entire surface of the dome without resting any weight on it. General contractor is the J. F. Fitzgerald Company, of Canton, Mass.

Location of Trans-Bay Tube Project Studied

The exact location and depth of the San Francisco Bay Area Rapid Transit District's trans-bay tube will be determined by studies started this January, according to Chief Engineer Keneth M. Hoover. This preliminary work involves drilling for soil core samples on the bottom of the bay and installing geophones to record earthquake vibrations along the proposed tube alignment. The cost of this phase of the work will be about $125,000.

Parsons, Brinckerhoff, Tudor-Bechtel, consulting engineers for the Rapid Transit District, have retained the San Francisco firm of Ben C. Gerwick, Inc. to carry out the drilling. United Electrodynamics, Inc., of Pasadena, has been hired to produce and install the nine permanent geophones on the bottom of the bay at depths of from 175 to 250 ft below the water surface.

Seismic vibrations picked up by the geophones will be transmitted by telephone cable to the San Francisco shoreline, from where they will be relayed to special seismic recorders located in the Bechtel Corporation's office. The seismic information will be assembled during the two-year period preceding the start of actual construction. Two experts in seismology—Dr. George W. Housner, M. ASCE, and Prof. F. J. Converse, F. ASCE, of the California Institute of Technology—have been retained as special consultants on the project.

The four-mile $84,000,000 transit tube will be a key link between Oakland and San Francisco in the projected five-county rapid transit system. Present plans call for a trench-type tube, to be constructed from prefabricated sections built above ground, then submerged and assembled at the tube site.

Some $115,000,000 for construction of the tube and its approaches has already been authorized by the California Legislature, to be allocated from surplus automobile tolls collected on the San Francisco-Oakland Bay Bridge.

FSIWA Changes Its Name

A change in the name of the Federation of Sewage and Industrial Wastes Associations to the Water Pollution Control Federation has been announced by Dr. Mark D. Hollis, F. ASCE, president of the Federation. The change, which became effective January 1, was voted at the organization's annual board meeting, held in Dallas, Tex., in October, and has since been confirmed by mail ballot of the membership. The Federation's monthly technical publication, known for the past decade as *Sewage and Industrial Wastes*, has also been renamed and will hereafter be called the *Journal of the Water Pollution Control Federation.*

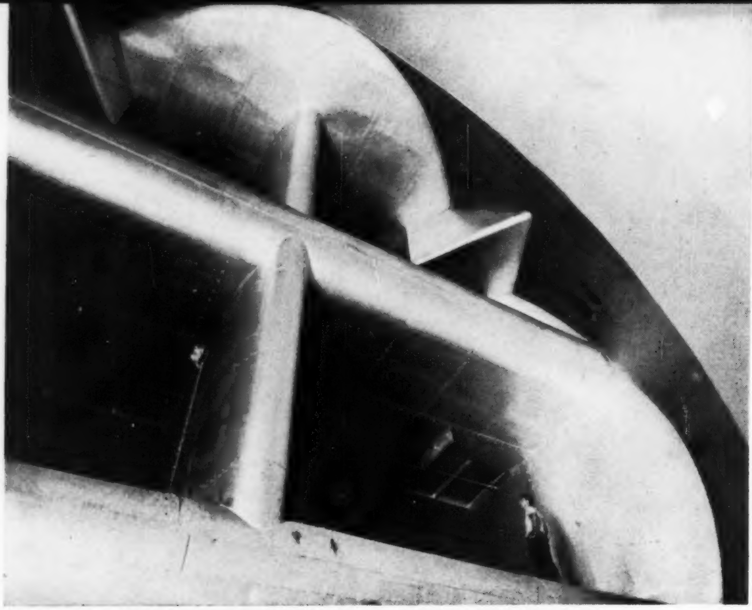
At its Dallas meeting the Federation Board of Control formally approved the use of "waste water" as a simpler and more appropriate term for "sewage and industrial wastes." The Dallas meeting was attended by over 1,300 sanitary engineers, scientists, and municipal and public health officials.

AISC Booklet Features Highway Bridge Tables

More economical construction of moderate-span highway bridges has been made possible by the use of tables, according to T. R. Higgins, director of engineering and research for the American Institute of Steel Construction. In announcing a new AISC booklet, Mr. Higgins noted that a multi-span continuous structure is often more efficient and economical than a series of simple spans, but that "the complicated calculations required have sometimes discouraged the use of such designs for shorter crossings subject to 'truck' loading."

The new AISC publication presents these computations in tabular form. Use of the tables will relieve engineers of time-consuming calculations. As an example of the economy of continuous design, the booklet cites a continuous four-span 360-ft bridge that would use 32 percent less steel than four simple 90-ft spans and also save on the number of bearing shoes and expansion joints.

The AISC booklet enables the highway bridge engineer to read from printed tables the maximum live and dead load bending moments, reactions, shears and impact coefficients per traffic lane, for a series of symmetrical two-, three-, and four-span continuous beam structures, varying in length from 60 to 480 ft. Free copies of the publication—entitled "Moments, Shears and Reactions—Continuous Highway Bridge Tables"—may be obtained from the American Institute of Steel Construction, 101 Park Avenue, New York 17, N. Y.



Air Force's Giant Wind Tunnel Nears Completion

Largest of the 22 wind tunnels and test cells at the U.S. Air Force's Arnold Engineering Development Center at Tullahoma, Tenn., is the propulsion wind tunnel, consisting of a transonic unit now in operation and a supersonic circuit nearing completion. Behind the grille shown are coolers through which more than 65,000 gpm of cooling water will be pumped to absorb heat from the air in the supersonic wind tunnel. When the tunnel is completed, giant compressors built by the Westinghouse Electric Corporation will drive air through the test section at velocities of from 1,000 to 3,000 mph. Construction of the wind tunnels and propulsion-system test cells is under the supervision of the Corps of Engineers Tullahoma District. Operating the Arnold Center for the Air Force is ARO, Inc., a subsidiary of Sverdrup & Parcel, Inc., of St. Louis.

Passenger-Cargo Terminal For Long Beach Harbor

The Long Beach (Calif.) Board of Water Commissioners has selected engineering and architectural firms to design a multi-million-dollar passenger-cargo terminal for one of the two new piers under construction in Long Beach Harbor. Picked to do the work were Moffatt and Nichol, Long Beach engineers, and two Los Angeles groups—Kistner, Wright and Wright, architects, and S. B. Barnes and Associates, structural engineers.

Before the start of construction, the three firms will conduct a land-use study of the pier and its adjacent area. Completion of the study and the terminal is set for late 1962. The terminal will be the Port's first passenger terminal in its 48-year history.

St. Louis Is Building Improved Water Line

A new $7,500,000 water line being installed by the City of St. Louis will provide a daily capacity of 240,000,000 gal—80,000,000 gal more than the outmoded line it is replacing. It will supply two-thirds of the city's needs. The new line, which is seven miles long, will extend south from the Chain of Rocks purification station to stations in the northern part of the city. Most of the line will consist of three parallel steel pressure conduits of 78-in. inside diameter, encased in a concrete envelope and lined with concrete.

The Fred Weber Construction Company, of St. Louis, is the general contractor on the project, and the Williams Brothers Construction Company, of Tulsa, Okla., the subcontractor on the pipe laying.

International Course in Hydraulic Engineering

A prospectus of the Fourth International Course in Hydraulic Engineering, announced in earlier issues, is now available. The course, to be held at the Technological University, Delft, Netherlands, will run from October 19, 1960, to September 14, 1961. Organized by the Technological University in cooperation with the Netherlands Universities Foundation for International Cooperation, the course is intended for civil and hydraulic engineering graduates with practical experience. Instruction will be in English.

The program offers a choice of three lines of study: (1) Tidal and coastal engineering (including harbors); (2) rivers and navigation works; and (3) reclamation (including ground-water recovery). The course will consist of lectures, group discussions, working visits, and a period of individual practical work, adapted to individual needs. At the end of the course diplomas will be awarded on the recommendation of the faculty. Prof. J. H. Thijsse, director of the Hydraulics Laboratory at Delft, is general supervisor of the course.

Tuition for the course is 2,000 Dutch guilders (about $526), payable in advance. The closing date for application is July 31, 1960. Further information may be obtained from the Netherlands Universities Foundation for International Cooperation, 27 Molenstraat, The Hague, Netherlands.

Navy's New Atomic Submarine Launched

The Scorpion, the Navy's newest atomic-powered submarine, was launched on December 19 at the Groton, Conn., shipyards of the Electric Boat Division of the General Dynamics Corporation. The new submarine will be powered by a reactor plant designed and developed by the Bettis Atomic Power Laboratory, which is operated for the Atomic Energy Commission by the Westinghouse Electric Corporation.

One of a group of high-speed, high-performance, nuclear-powered submarines now being constructed by the Navy, *The Scorpion* has a streamlined hull and single propeller. According to the Navy, its sister ship, *The Skipjack,* has achieved the highest speed ever made by a submarine.

Narrows Bridge Financing

Full responsibility for the financing and construction of the $320,000,000 Verrazano-Narrows Bridge over New York Harbor has been assumed by the Triborough Bridge and Tunnel Authority in a joint statement issued by the Authority and the Port of New York Authority. The Triborough Authority will also repay the $30,000,000 already borrowed by the Port Authority to begin construction. The agreement between the two agencies stipulates that the Triborough Authority will acquire the facility from the Port Authority by January 1, 1967.

The Narrows Bridge is a key feature in a $575,000,000 arterial construction program undertaken by the two agencies on the basis of Metropolitan area traffic needs revealed by a six-year joint study. Other projects included in the comprehensive improvement program include a

six-lane lower level to the George Washington Bridge; the Throgs Neck Bridge over the East River; and an extensive and costly highway system feeding into the new bridges. The feeder highways are being built by the States of New York and New Jersey with major financial contributions by the Federal Government.

2.7 Billion Ft of Sewer Pipe Will Be in Use by 1975

A total of about 2,700,000,000 ft of sewer pipe will be installed and in use by 1975 for sewer mains in public storm and sanitary sewer utilities of the continental United States. This estimate has been made by the Water and Sewerage Industry and Utilities Division of the Business and Defense Services Administration, following a recent study. These sewer mains will serve as collection mains, interceptors and disposal lines for industrial and commercial waste, domestic sanitary sewage, and storm waters.

In September 1959, the Division released the results of its study of the national annual requirements for sewer pipe for sewer mains and related uses. This study was entitled, "Sewerage Utilities, Sewer Pipe Requirements for Mains," and is available from the Superintendent of Documents, Washington 25, D.C.

From the National Science Foundation

In connection with its programs for the support of basic research, the National Science Foundation for some years has followed the policy of permitting institutions to apply for and receive, as an indirect cost allowance, up to 15 percent of the total direct costs involved in approved grant proposals. Because of rising costs of administration and the adverse effect of such increases upon the ability of institutions to carry on research work, the Foundation will now permit institutions to request up to 20 percent of total direct costs as the allowance for indirect costs in research proposals. However, such indirect costs may not exceed the last "audited" or "negotiated" rate approved for the institution by a Federal agency for purposes of government-sponsored research and development.

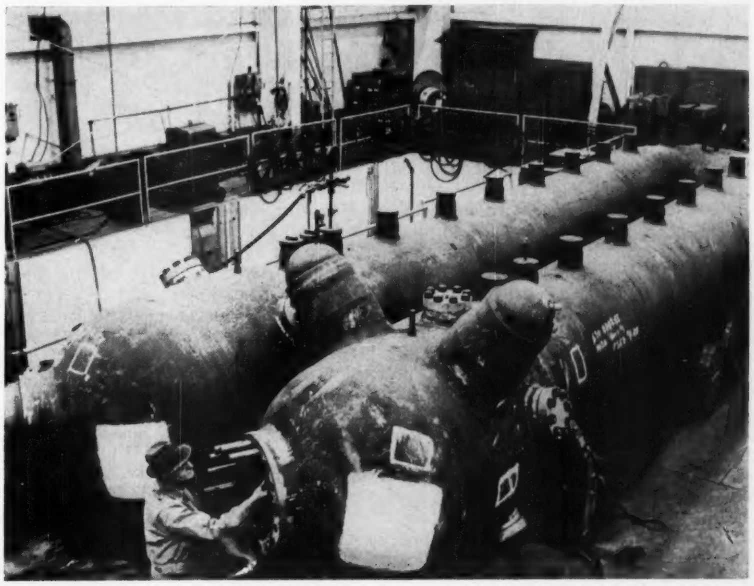
The National Science Foundation also announces that the next closing date for receipt of proposals for supporting the renovation and/or construction of graduate level (doctoral) research laboratories is March 1. Proposals received prior to that date will be reviewed during the late spring and early summer. Proposals received after the March 1 closing date will be reviewed following the next closing date which is expected to be September 1, 1960.

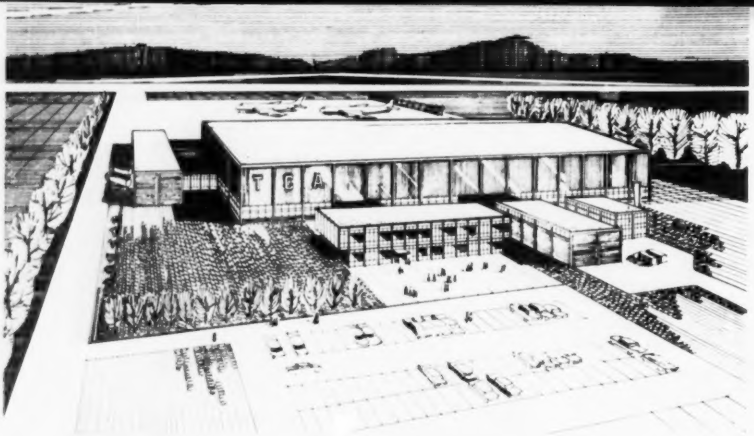
Traffic started rolling December 12 across the Julia Tuttle Causeway, Miami's new six-lane three-mile link with Miami Beach that is cutting driving time between the two cities by as much as 20 minutes. The $14,000,000 causeway includes two shipping lane bridges, two and a half miles of bulkhead fill, two highway overpasses, and four interchange bridges. Two years in the building, the toll-free project is the first part of an elevated expressway system which will extend to Miami International Airport. It is part of the Federal highway system.

New Speedway Connects Miami and Miami Beach

First Heat Exchanger for Con Edison Atomic Plant

This 60-ton heat exchanger will become one of four generators used to convert nuclear heat into steam at the Consolidated Edison Company's nuclear electric generating station at Indian Point, N. Y. The unit is shown undergoing final inspection at the Babcock & Wilcox Company's Barberton, Ohio, boiler works. It is 40 ft long and 13 ft wide, and contains 10 miles of 1-in. stainless steel tubing. The 275,000-kw station will provide electricity for some 250,000 homes in the New York City-Westchester area. The heat exchanger is the first of four scheduled for delivery during the next four months by Babcock & Wilcox, designer and builder of the nuclear part of the power plant. The station is being built entirely with private funds.





Jet Base for Vancouver International Airport

Mammoth new jet maintenance base will be built this year at Vancouver International Airport by Trans-Canada Air Lines to provide servicing facilities for its new jet liners. The $5,000,000 base will have the second largest jet hangar development in Canada. Long-span steel roof trusses have been selected for the hangar bays to permit unobstructed movement of large aircraft. Insulated aluminum sandwich panels will be used for the hangar wall cladding, and ribbed steel decking will support the insulated pitch and gravel roof. Completion of the base is expected by the fall of 1960. Consultant on the project is the Vancouver firm of Phillips, Barratt and Partners.

EXAM GEMS

by Reggie Strashu

R. ROBINSON ROWE, F. ASCE

EXAMGEM No. 7, an Alaskan problem, asked for the stopping distance for a 4,000-lb car running 50 mph on the level, first with rear-wheel and second with 4-wheel brakes. Gem quality lay in (1) redundancy of the weight, (2) forward shift of weight with braking, and (3) practical limitations on safe braking.

Candidates who didn't recognize the redundancy had a little extra work with their slipsticks. Others took the car's mass as m, its weight as mg, and its inertia as ma, where a is the negative acceleration due to braking. These act at the centroid G (Fig. 1) and are balanced by uplifts of R and F at rear and front wheels and retardants of A and B due to friction. The latter being limited by a coefficient of 0.6, we can write:

$R + F = mg$ . . . . (1)

$A + B = ma$ . . . . (2)

$A,B \leqq 0.6\ R,F$ . . . . (3)

It was no trick to convert 50 mph to $v = 220/3$ fps and establish the stopping distance in terms of deceleration as:

$s = \frac{v^2}{2a} = \frac{24,200}{9a}$ . . . . (4)

Mr. Avrijman equated moments about F, neglecting the inertial force, to find $R = 0.4\ mg$, $F = 0.6\ mg$. For rear-wheel brakes, he said $B = O$, $A = ma = 0.6\ R = 0.24\ mg$, so $a = 0.24g$ and

$s_r = 24,200/2.16g = 348$ ft

For 4-wheel brakes, he wrote $A + B = ma = 0.6\ (R+F) = 0.6\ mg$, so $a = 0.6g$ and

$s_4 = 24,200/5.4g = 139$ ft

Mr. Betrman knew why the front of his car seemed to dive when he put on his brakes, so he allowed for the inertia when he took moments. First making $A = ma$ and $R = ma/0.6$,

$10ma/0.6 + 2ma = 4\ mg$

$a = 3g/14$

$s_r = 338,800/27g = 390$ ft

This was smart, but he agreed with A that $s_4 = 139$ ft, which wasn't quite smart enuf. Mr. Champman was still smarter. He remarked that the drag of 2,400 lb required to stop the car in 139 ft would have to be divided 1,728 lb on the front tires and only 672 on the rear. Standard brakes couldn't do that without locking the rear wheels, probably skidding the car but surely changing the coefficient of friction. Braking torque of bands on drums is independent of wheel loads, except for the limit. So he made $A = B = \frac{1}{2}ma = 0.6R$, and found,

$10ma/1.2 + 2ma = 4mg$

$a = 12g/31$

$s_4 = 187,550/27g = 216$ ft

This is the best answer for ordinary equipment. If you want to stop quicker,

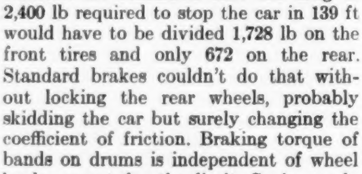


Fig. 1. A front-heavy car is hard to stop.

you need either two brake pedals or 6 passengers in the back seat, although running backwards would help. In fact, the text didn't say which way the car was running, so if you want to quibble, the answer could be 144 ft!

EXAMGEM No. 8

Examgem No. 3 aroused some collateral interest in uplift pressure under dams, drawing attention to this problem used by Colorado several years ago. Don't be misled by its simplicity.

A trapezoidal concrete dam weighing 150 lb per cu ft is 10 ft wide at the top 16 ft wide at the base, 40 ft high, water face vertical. If water stands within 4 ft of the top and the uplift coefficient is 0.3, varying uniformly, determine the maximum and minimum intensities of pressure on the base.

Los Angeles to Have New Federal Office Building

Designs for a new multi-million-dollar U.S. Custom House and Federal office building, to be constructed in Los Angeles, have been approved by the General Services Administration. The eight-story building, which will cost an estimated $31,154,000, will provide almost 1.2 million square feet of modern, air-conditioned office space for 23 U.S. Government agencies and bureaus now scattered about the city. It will house some 4,800 employees.

The extensive floor area and relatively low height are in keeping with the overall architectural pattern developed for the Civic Center in which it is to be located. The frame of basic steel construction will feature metal and glass for the facing of the first two stories and horizontal strip windows alternating with precast spandrels of polished marble slabs for the upper floors. The first and second floors will be recessed to provide partial cover for the 28-ft promenade that will surround the building at ground level.

U. S. Steel Capacity Reaches New High

As of January 1, the nation's annual steelmaking capacity was a record 148,570,970 tons, according to the American Iron and Steel Institute. The present capacity represents a gain of 937,300 tons in the past year, despite the long steel strike that forced some companies to stop work on expansion projects. The largest increase in 1959 was in electric furnace capacity, which stands at 14,395,940 tons a year. These furnaces now account for almost 10 percent of the total annual capacity figure.

Last year's gain in capacity was the thirteenth successive increase. The new capacity is 62 percent higher than the potential at the end of the war, and 31,000,000 tons above the industry's peak annual output of 117,000,000 tons in 1955.

K·M ASBESTOS-CEMENT PRESSURE PIPE

Exclusive, patented FLUID-TITE Coupling connects in only two easy steps!

Streamline installation . . . reduce costs and time with modern "K&M" Asbestos-Cement Pressure Pipe.

To connect pipe to FLUID-TITE Coupling, just lubricate the rubber gasket—and slide the pipe in. Lay more pipe per hour than ever before, and do it under all soil and weather conditions.

Tough, hardy "K&M" Asbestos-Cement Pressure Pipe firmly holds down pumping costs and maintenance costs. Won't corrode or tuberculate, and is completely immune to electrolysis. Permanently sealed joints remain root-tight and water-tight always.

What makes "K&M" Asbestos-Cement Pressure Pipe so special? Eighty-five years of asbestos engineering by one of America's pioneers in asbestos products. Put this wealth of experience to work for you. Write to us today.

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BEST IN ASBESTOS

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OZALID NEWSLETTER

NEWS AND IDEAS TO HELP YOU WITH ENGINEERING REPRODUCTION AND DRAFTING

Repro room at I-T-E, showing processing of Information Sheets and standard engineering drawings on Ozalid machines. Simple system saves hours of drafting time for the company.

Short-cut system for custom orders

To help turn out "job shop" work at assembly line speed, the I-T-E Circuit Breaker Company of Philadelphia has devised a simple "Information Sheet" that does away with considerable retracing and revising of engineering prints.

More than 70% of I-T-E orders are for custom-designed equipment using standard components. Revising standard drawings to meet customer specs on each order would saddle I-T-E's engineering department with a nearly impossible work load.

So the Information Sheet is used instead. It's an 8½" x 11" tracing form—with printed title blocks—quickly reproduced on the company's Ozalid whiteprinters. Here's how it works:

An order comes in—for 5KV metal-clad switchgear, for instance. A fast freehand sketch of the switchgear is drawn on the Information Sheet. Drawing numbers of standard components and quantity of prints needed are noted on the Sheet.

Then, copies of the Sheet and the required standard drawings are run in the I-T-E repro room. These, with the shop order, go to Manufacturing. When the order is completed, the Information Sheet is returned to the customer file for reference.

This simple short cut with Ozalid whiteprinting saves untold hours of engineering time and gives I-T-E customers faster, more efficient service.

Colors speak louder than words

A simple way to make your security personnel's job a lot easier is to color-code all classified material by using Ozalid sensitized color-copy papers. Colors don't have to be read. Guards can spot restricted or top-secret prints at a glance. Clerks can't make routing mistakes.

To help you devise your own color-coding systems, Ozalid offers papers with eleven image-and-stock color combinations. For example, use black image on yellow stock (instead of traditional blue on white) to code prints of preliminary drawings. Potential uses for color-coding in engineering paper work are virtually unlimited: shop orders, bills of material, spec sheets, change notices, cost estimates, etc., etc.

Like a copy of our new Color-Coding Booklet? It tells how a truly versatile, full-range color-coding system can be yours with as little effort as it takes to run prints that are black on white.

Just write to Ozalid, Johnson City, New York. Booklet No. QQ2.

New blue-tint Ozacloth cuts glare, saves eyes

It's bad enough to have *people* glare at you. When your drafting materials glare too, one should take steps. Our research people have—by building a delicate blue tint into our new black-line Ozacloth 101 CZB. It provides excellent contrast between background and dye image—cuts glare, reduces eye strain, makes duplicate originals that are easy to read and work with. Other features? Highest printing speed of any cloth intermediate . . . and a plastic matte surface *on both sides* which accepts pencil, ink or typewriter . . . and keeps sheets from sticking together in files. Write Ozalid at Johnson City, New York, for free descriptive literature on blue tint Ozacloth.

***Ozalid**—Division of General Aniline & Film Corp. • In Canada: Hughes-Owens Co., Ltd., Montreal*

The Chase Manhattan Bank Building

A BETHLEHEM STEEL REPORT ON ONE OF THE SIGNIFICANT STRUCTURES OF OUR TIME

BETHLEHEM STEEL

Architect: Skidmore, Owings & Merrill; consulting foundation engineers: Moran, Proctor, Mueser & Rutledge; consulting structural engineers: Weiskopf & Pickworth; consulting mechanical engineers: Jaros, Baum & Bolles; consulting electrical engineers: Meyer, Strong & Jones; general contractor: Turner Construction Company.

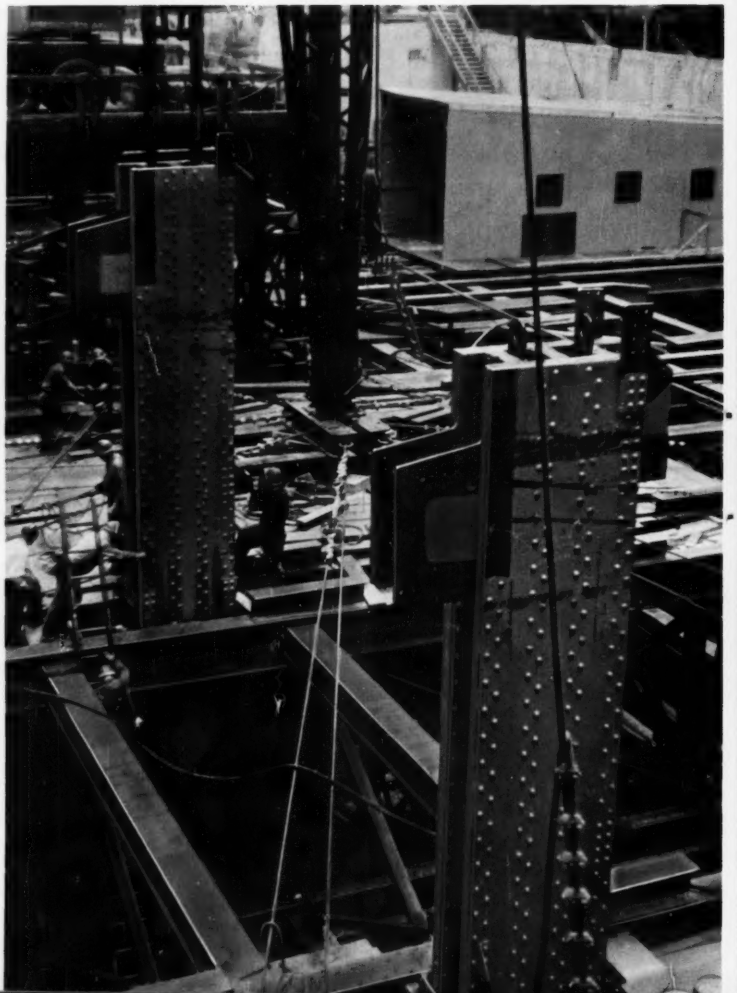
"Like a shaft of light..."

This apt phrase was used by an architectural journal in describing the design of the new headquarters of The Chase Manhattan Bank. Its lofty tower of glass and metal will glow amidst the somber facades of lower Manhattan. And, occupying only about a third of the $2\frac{1}{2}$-acre site, it brings sunlight and air and spaciousness to the dark canyons of Wall Street.

Fifteen thousand employees will occupy the building, which rises sixty stories into the air, and extends five floors below ground level. Gross floor area is more than 2.3 million sq ft. The tower rises 810 ft without setbacks, and is approximately 281 by 107 ft in plan. It required approximately 53,000 tons of structural steel, fabricated and erected by Bethlehem. Nearly 5,000 tons of this total, plus some 1,100 tons of sheet piling, were required for the substructures alone.

BETHLEHEM STEEL

The column sections, up to 36 ft long and up to 52 tons in weight, were fabricated at Bethlehem's Pottstown Works. Made from heavy plate material, the sections' outside dimensions are uniform up the entire 810-ft height of the structure.

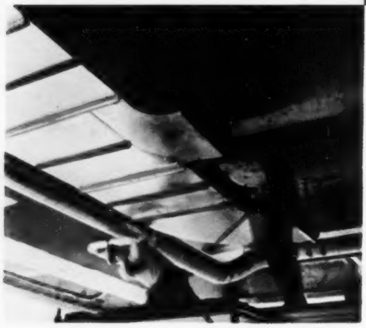


This project marked the first time that permanent floor steel was used as a horizontal strut system, or crosslot bracing, replacing the usual temporary bracing of cofferdams. The steel was erected downward from grade. As each level was placed and jacked to brace the outer walls, the contractors (The Foundation Co., George M. Brewster & Son., Inc., and Joseph Miele Construction Co., Inc.) excavated to just below another level, allowing more steel to be erected. This process was followed for five subsurface levels, to a depth of 80 ft.

Steel decking, made by a Bethlehem sheet customer, was used throughout the building. It was laid quickly and economically; no need for forms. Electrical raceways provide flexibility for the huge open floor areas. Movable steel wall partitions have been designed by the architects and fabricated for use in this building.

An ironworker tightens Bethlehem high-strength structural bolts, used for all field connections. Bolting is faster, quieter, and safer than riveting and makes tighter joints.

Some 1,500 tons of Bethlehem electric resistance-weld and continuous butt-weld steel pipe were used for the water lines of the heating and air-conditioning system.



The 9,000-ton-capacity air-conditioning system is believed to be the largest ever installed in a commercial office building. The ductwork shown here was made from Bethcon, continuously galvanized steel sheets.

Bethlehem Products for Construction

Structural shapes; a full line of industrial fasteners; concrete reinforcing bars and specialty products; Bethlehem Slabform for poured concrete floors and roofs; wire rope, strand, and elevator cable; open-web joists; steel pipe in all diameters; sheet and H-piling; galvanized steel sheets; hollow drill steel; and a complete range of highway construction products.

Bethlehem Steel Company, Bethlehem, Pa.

Export Distributor: Bethlehem Steel Export Corporation

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Name ____________________

Address ____________________

____

DECEASED

Frederick J. Anderson (M. '26; F. '59), age 81, former South Bend (Ind.) city engineer, died there recently. As city engineer from 1915 to 1926 and from 1935 to 1950, he was instrumental in planning South Bend's first zoning and planning ordinance, in planning all its track elevations, and in the rerouting of the St. Joseph River. He also assisted in the construction of bridges over the river.

John Ernest Bing (M. '58; F. '59), age 44, for the past nine years a member of Robert & Company Associates, in Atlanta, Ga., died there on December 11. His principal duties with Robert & Company consisted of job administration on work with the U. S. Armed Forces. Mr. Bing was in the Army from 1943 through 1947 and an active member of the Corps of Engineers Reserve with the rank of Lieutenant Colonel. He was immediate past president of the Georgia Section.

Allan Lee Chollar (M. '54; F. '59), age 55, with the U.S. Bureau of Public Roads at Charleston, W. Va., died in Houston, Tex., on December 7. For a number of years Mr. Chollar was resident engineer for the Texas State Highway Department for numerous counties. He was in charge of a study for a highway development plan for Corpus Christi and Nueces counties.

Verne Gongwer (M. '27; F. '59), age 73, who retired in 1947 as chief engineer of the Tacoma City Light Company in Washington, died recently in Twentynine Palms, Calif. Mr. Gongwer began working for Tacoma City Light in 1923 as a civil engineer on the Cushman Dams and three years later was design engineer for the world-famous Narrows Transmission crossing, the longest of its kind when it was built. More recently he was with the Army Corps of Engineers and the Navy Bureau of Yards and Docks.

Charles R. Denison (A.M. '46; M. '59), age 54, since 1946 senior engineer and then planning officer with the Maritime Administration in Washington, D. C., died there recently. Mr. Denison's early career experience included twelve years with the Corps of Engineers in Philadelphia and three years, during World War II, as staff officer for the European Theatre of Operation Staff preparing plans for the Normandy invasion.

R. Waldo Fox (A.M. '38; M. '59), age 60, for many years associated with the U.S. Army Corps of Engineers in the construction of power stations, died recently in Fort Smith, Ark. Since retiring, he had been associated with the Fox and Turner clothing store in Fort Smith. He was a graduate of the Massachusetts Institute of Technology.

Andrew Warwick Gatewood (M. '47; F. '59), age 78, of the Gatewood Engineering and Supply Company, Pulaski, Va., died there recently. For many years Mr. Gatewood was director of public works and city engineer of Pulaski exercising general charge of all city departments except fire and police.

Nathan Henry Gellert (M. '37; F. '59), age 70, consulting engineer and retired president of the Seattle (Wash.) Gas Company, died in Seattle recently. A leading advocate of low-cost natural gas, Mr. Gellert retired from Seattle Gas in 1955 to become executive partner in the Seattle consulting engineering firm of Gellert, Griffin, Harrigan and Associates.

C. C. Halkyard (A.M. '21; M. '59), age 70, chief engineer of Humes, Ltd., in Melbourne, Australia, died recently in Sydney. Mr. Halkyard's experience included several years as hydraulic engineer with the Hydro-Electric Department in Tasmania, where he had charge of design and construction of the 10,000 hp Great Lake Hydro-Electric Scheme.

William Henry Hoff (A.M. '21; M. '59), age 78, civil engineer of Kearny, N. J., died there recently. In private practice since 1908, Mr. Hoff was consultant on many local projects, including a $300,000 cemetery at Carteret and several schools. For several years he was North Arlington Borough engineer.

Joseph P. Laws (A.M. '25; M. '59), age 65, office engineer for the J. A. Jones Construction Company in New York City, died there recently. Prior to joining the staff of J. A. Jones, Mr. Laws had worked as erecting engineer with the J. A. P. Crisfield Construction Company, the Tennessee Valley Authority and the Maxton Construction Company.

William Hugh McCasland (J.M. '55; A.M. '59), age 26, a 1955 graduate of the Louisiana Polytechnic Institute, died in a plane crash recently. He was employed as a graduate assistant in the department of civil engineering at Iowa State College until recently when he joined the United States Air Force in Sacramento, Calif., as a 2nd Lieutenant.

Carl Edward Nordeen (A.M. '34; M. '59), age 71, since 1916 a member of the staff of the U. S. Geological Survey, died recently at Mount Ranier, Md. From 1951 until his retirement in 1956, he was regional hydraulic engineer for the Eastern Region of the Survey. He was coauthor of "History of Land Classification in the United States Relating to Water Power and Storage Sites," and a holder of the Department of Interior Meritorious Service Award.

Ernesto Pichler (A.M. '48; M. '59), age 57, a specialist in applied geology and civil engineering, died recently on a field job in Sao Paulo, Brazil. At the time of his death, Mr. Pichler was an assistant engineer with the Instituto de Pesquisas Tecnologicas at the University of Sao Paulo.

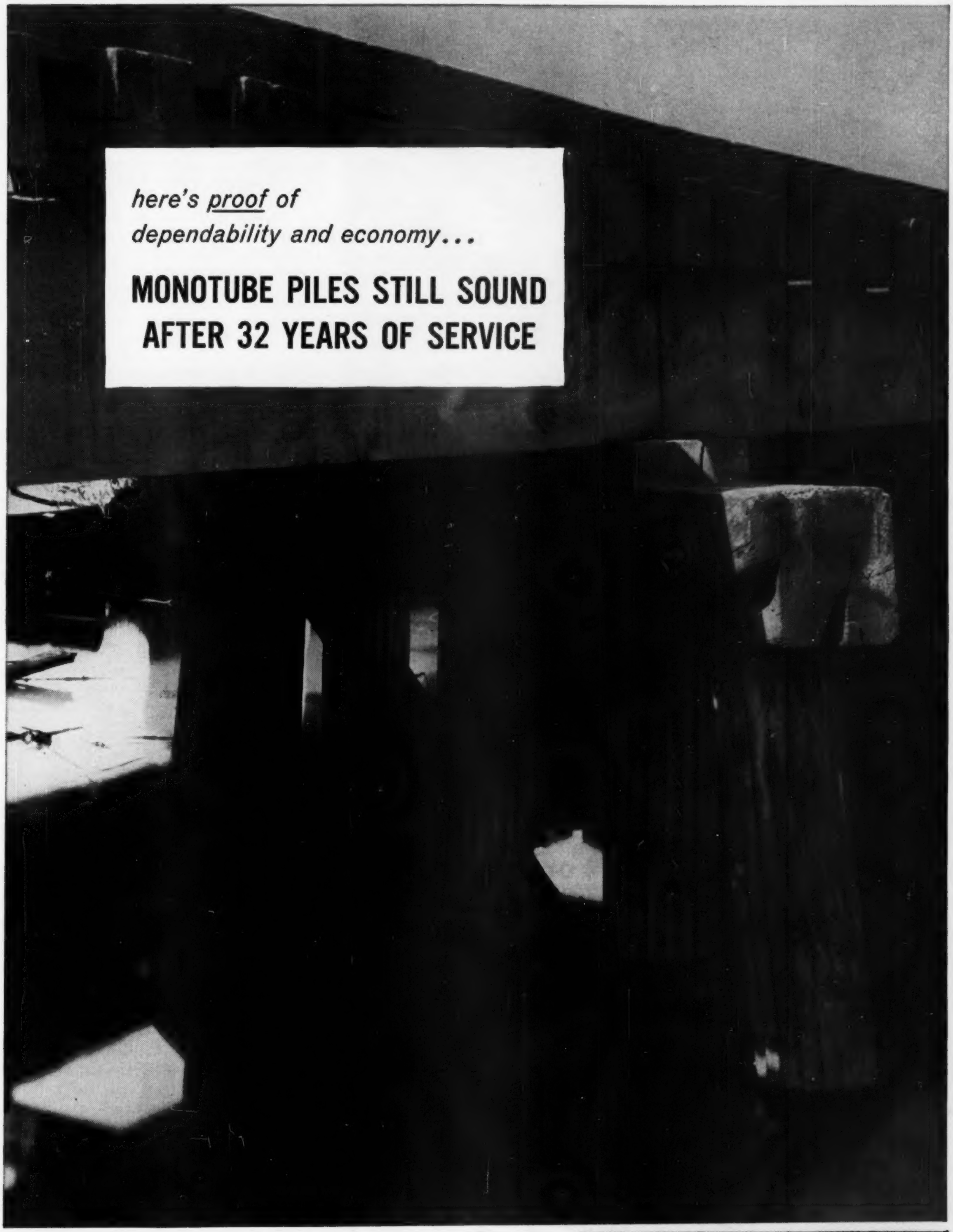
Francis J. Radigan (M. '25; F. '59), age 69, from 1923 until his retirement in 1951, Hudson County (N. Y.) engineer, died on December 5, in Nice, France, while on a world tour. Since his retirement, Mr. Radigan had his own consulting practice in Jersey City, N. J.

James F. Scrimshaw (M. '21; F. '59), age 84, retired civil engineer and builder, died in East Orange, N. J., on December 3. For more than fifty years, Mr. Scrimshaw was associated with the Salmond, Scrimshaw Construction Company of Kearny, N. J., and from 1935 until his retirement in 1955 was president of the concern.

Siegfried Werner Spielvogel (M. '35; F. '59), age 67, a staff member for Byrne Associates of New York City, died there on December 14. For thirty-two years Mr. Spielvogel, an authority on pipe stresses, served with the Consolidated Edison Company of New York, retiring two years ago to become connected with Byrne Associates.

James Polk Steele (M. '48; F. '59), age 60, since 1945 president and general manager of his own firm, the J. P. Steele Construction Company, at Laramie, Wyo., died in Laramie recently. Mr.

(Continued on page 112)



In 1928 the first steel Monotube foundation piles were installed on one complete bent of a Wheeling and Lake Erie Railroad trestle bridge. A recent inspection proved the installation to be in excellent condition . . . ready for many more years of service.

Tapered, fluted Monotube steel piles are available in lengths, diameters and gauges to meet every requirement. The Union Metal Manufacturing Co., Canton 5, Ohio; Brampton, Ontario, Canada.

UNION METAL

Monotube Foundation Piles

Deceased

(Continued from page 110)

Steele did extensive work throughout the State of Wyoming, including the construction of numerous buildings on the University of Wyoming campus. He was a past president of the Wyoming Section and contact member for the University of Wyoming Student Chapter.

Harvey B. Taylor (M. '27; F. '59), age 77, retired shipbuilding executive, engineer and designer of turbine machinery, died in Newtown Square, Pa., on December 29. Mr. Taylor designed and manufactured turbines for water-power developments at Niagara, Keokuk, Muscle Shoals and Conowingo in this country and Ceders Rapids and Shawinigan in Canada. In 1915 he became assistant to the president of the Cramp Company, a world famous shipyard founded by his grandfather, and later served as president of Cramp-Morris Industrials, Inc.; Federal Steel Foundry Company; I. P. Morris and De La Vergne, Inc.; the Pelton Water Wheel Company; and Cramp Brass and Iron Foundries Company.

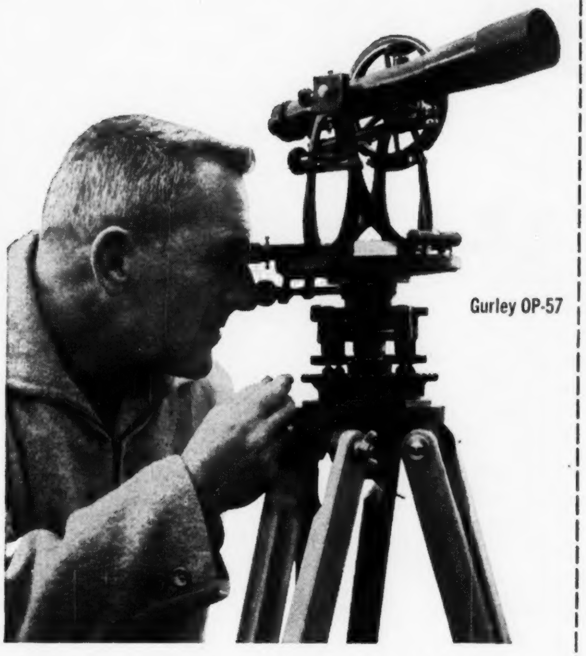
Paul Adolph Uhlmann (M. '46; F. '59), age 67, until his retirement a few years ago a partner in Uhlmann & Associates, of Columbus, Ohio, died recently in Sarasota, Fla. Before establishing his own practice, Mr. Uhlmann had been an assistant professor at the Technical College of Stuttgart, Germany, and a consulting engineer specializing in sewerage and sewage treatment plants.

Morrell Vrooman (A.M. '02; M. '59), age 84, a nationally known hydraulic and sanitary engineer and founder of Morrell Vrooman Engineers, at Gloversville, N. Y., died there recently. He worked as engineering consultant to municipalities for sixty-four years—with the exception of World War II when he closed his business to become chief engineer with the Army for all construction at Fort Dix, N.J. One of the last projects in which Mr. Vrooman participated actively was a $2½ million sewage treatment plant at Poughkeepsie, N. Y.

Edward Wentzel (A.M. '31; M. '59), age 69, a retired civil engineer of Philadelphia, Pa., died there recently. Mr. Wentzel's most recent job was as engineer with Cities Service Oil Company of Pennsylvania at the Petty Island (N. J.) office. Earlier he had been construction engineer with the H. L. Doherty Company of New York City, and the Crew Levick Company of Philadelphia, Pa.

Joseph Winston (M. '48; F. '59), age 71, for the past twenty years civil engineer with the New York City Board of Water Supply, died recently in New York. For several years he was chief engineer and general manager of the Tee Stone Corporation which manufactured and erected T-shaped reinforced concrete units of his own invention, and for ten years he did extensive work on a joint sewerage and water supply trunk for eleven municipalities in New Jersey.

Built-in optical plummets eliminate plumb bobs save set-up time...improve accuracy



Gurley OP-57

Gurley OP-137

The Gurley Optical Plummet Transit (Model OP-57) has proved itself to be such an important time and money saver in the field that this optical plummet feature has also been added to the Model 132 Standard Precise Transit. The new transit will be known as the OP-137.

Both these Optical Plummet Transits will save you time and trouble in setting over a point. The OP-57 and OP-137 eliminate the swing and sway of the cord and plummet—exasperating and time consuming. You will especially appreciate the increased accuracy on windy locations.

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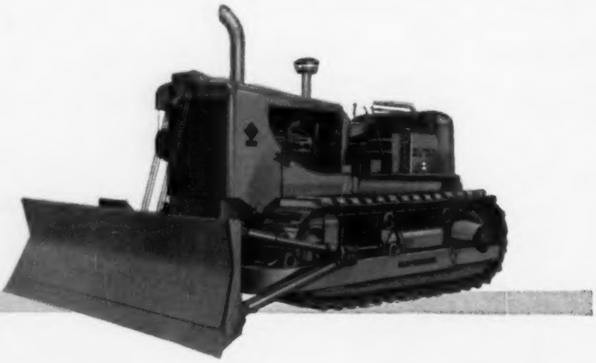

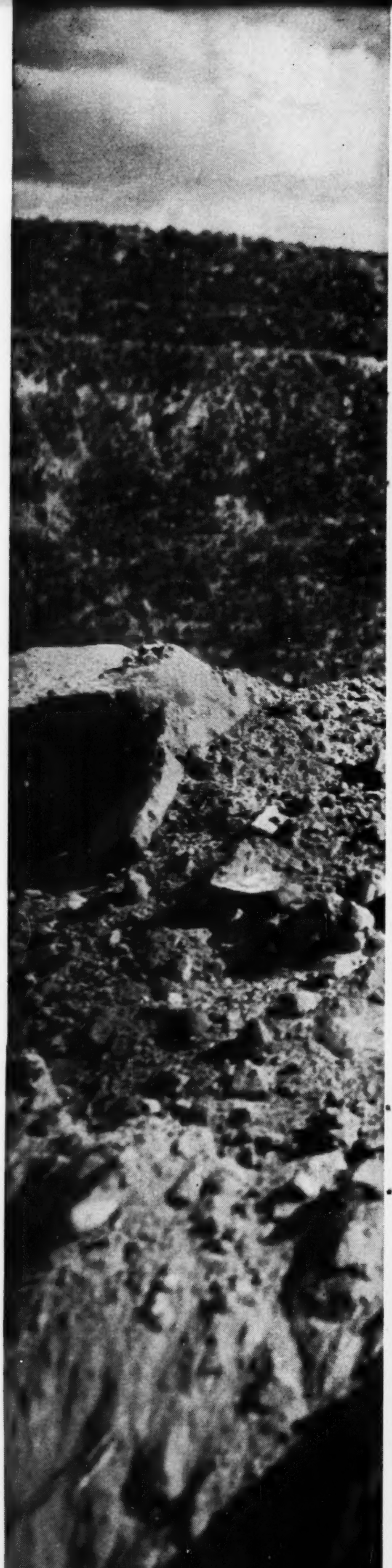

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NEW IN EDUCATION

Georgia Tech Ranks High in Research

The Georgia Institute of Technology carried out $2,680,000, or over 38 percent of all engineering research among the sixteen universities and colleges in the Southeast which are members of the nation-wide Engineering College Research Council. Georgia Tech's high ranking in research was made possible by over $2,383,000 in research and development projects sponsored by industry and government through the Georgia Tech Engineering Experiment Station.

Graduate Work in Sanitary Engineering

A research program, to develop a more economical and effective means for treatment of wastes, a problem facing American communities, will be directed by Dr. Leon Weinberger, M. ASCE, associate professor of civil and sanitary engineering at Case Institute of Technology, as the result of two grants from the Public Health Service. The grants, which will provide more than $100,000 during the next three years mark an important step in Case's program to strengthen its graduate work in sanitary engineering. Included in the expanded program is a new research laboratory to be constructed within the year.

New Engineering Building At Manhattan College

A campaign to raise $5,000,000 for an engineering building at Manhattan College was opened recently. The proposed seven-story structure on the school's campus in Riverdale, N. Y., would provide facilities for 1,000 students. Attending the campaign-dinner were James A. Farley, former U. S. Postmaster General and chairman of the college's engineering development program; Cardinal Spellman; New York's Mayor Wagner; and John F. Brosnan, chancellor of the New York State Board of Regents.

Courses in Atomic Shelter At Pennsylvania State

Two engineering seminars on atomic shelter at Pennsylvania State University scheduled for this summer will present a wealth of information in this vital field. The first two-week short course, July 10-22, will deal with architectural and engineering planning aspects, while the second, from July 24 to August 5, will deal with structural engineering and radiation shielding aspects. Further information is available from the seminar chairman, Gifford H. Albright, Assistant Professor of Architectural Engineering, Pennsylvania State University, University Park, Pa.

Traffic Engineering As a Career

The Bureau of Highway Traffic at Yale University has announced the availability of fellowships for the 1960-61 academic year to be awarded to qualified graduate engineers who are citizens of the United States and would like to enter the profession of traffic engineering as a career. The fellowships provide for tuition of $800, a living stipend of $1,400, which amounts to a total value of $2,200 for each fellowship. The Bureau also offers tuition scholarships to qualified municipal and state highway engineers who will receive financial aid from their employers while undertaking graduate work. Applications for admission and further information may be obtained by writing to Fred W. Hurd, Director, Bureau of Highway Traffic, Yale University, Strathcona Hall, New Haven, Conn. The closing date for filing applications is March 1, 1960.

New Civil Engineering Ph.D. Program

The College of Engineering of the University of Arizona has added a new program leading to a Ph.D. in civil engineering, because it is felt that students must complete work at this level in order to fill the need for research and development personnel and engineering teachers. The University has been encouraged by the fact that five of the eighty-one National Defense Scholarships awarded to engineers were given to its engineering department. Theirs was the only civil engineering program in the entire country, and was chosen from 1,000 program proposals and 6,000 scholarship applications in all fields of science. Graduate assistantships, instructorships, and scholarships are being offered as part of the program. For further information, please write to Gene M. Nordby, Head, Department of Civil Engineering, University of Arizona, Tucson, Ariz.

University of Illinois Receives Ford Grant

The University of Illinois has received a $275,000 grant from the Ford Foundation for experimental projects in strengthening engineering faculties. From the funds $150,000 will be allotted to grants and loans aiding thirty or more teaching assistants to complete work for the doctorate. Another $100,000 will be used to bring distinguished men to the campus as visiting professors, and $25,000 will go for faculty exchange with other universities.

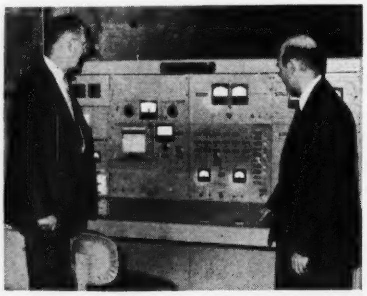
Summer Institute in Nondestructive Testing

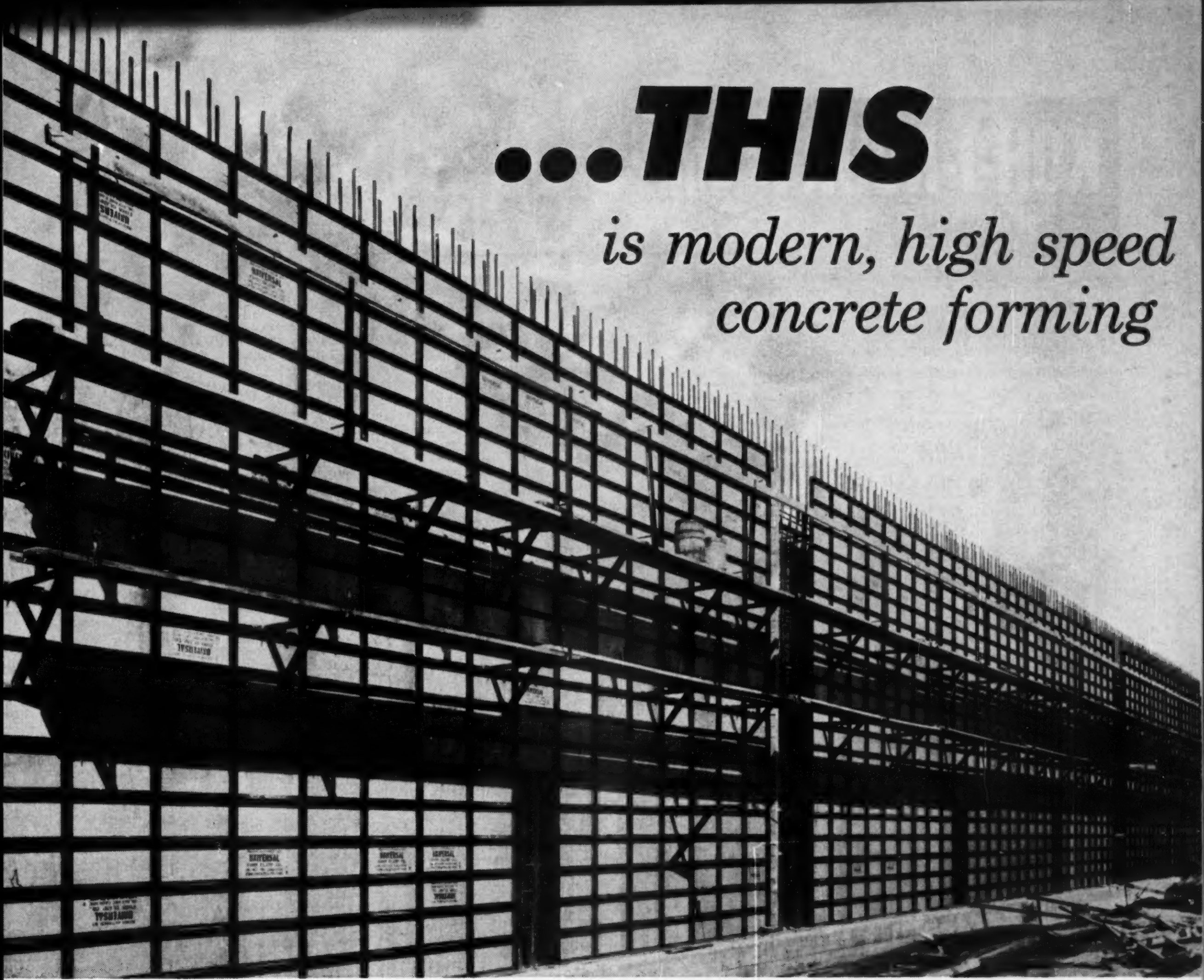
In response to requests from industries and government agencies of the west coast to Sacramento State College in California is offering an intensive two-week program of instruction, from August 15 through 26, 1960, in the fundamental principles and proper application of nondestructive test methods. The program, known officially as the Summer Institute in Nondestructive Testing, will begin with the principles underlying each test method, and progress to advanced forms of equipment and techniques. Sessions will be held for eight hours daily, five days a week, and no prerequisite training and experience is required for participants. All requests for information should be addressed to Dr. George N. Beaumariage, Jr., Summer Institute in Nondestructive Testing, Department of Engineering, Sacramento State College, 6000 Jay Street, Sacramento 19, Calif.

Iowa State Gets Nuclear Reactor

Iowa's first nuclear reactor for the education of nuclear engineers is now in operation on the campus of Iowa State University at Ames. First teaching reactor of its kind west of the Mississippi River, the 150-ton device, capable of developing 10,000 watts, will not be used to develop power for commercial purposes but will be used for research and instruction of students. The program, since its inception in 1951, has become one of the engineering college's largest graduate programs and includes in the present enrollment Army, Navy, and Air Force personnel as well as civilians. Of the total cost of $200,000 for the reactor, the Atomic Energy Commission contributed $150,000, and the University the remainder.

Dean George R. Town and Dr. Glenn Murphy, F. ASCE, at the control board of the new nuclear reactor at Iowa State.





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RECENT BOOKS

(added to the Engineering Societies Library)

American Power Conference, Proceedings, 1959

These papers give practical information to those concerned with the generation, transmission or utilization of power. The book is divided into sections of general interest: nuclear energy; electrical, mechanical, and water technology. The papers in each of these areas cover technical, economic, and industrial aspects. They are written by people connected with universities and societies, industries and government, laboratories and utilities. (Published by the Illinois Institute of Technology, Technology Center, Chicago 16, Ill. 776 pp., bound. $8.00.)

Civil Engineering Refresher for Professional Engineers License

This book is to help prepare the practicing civil engineer to pass the civil engineering examination for Professional Engineer. Included are problems on surveying, highways, fluid mechanics, hydraulics, water supply and sewerage, structures, soil mechanics, and construction, obtained from past examinations of representative states. A reference source follows each solution and time-savers are offered for each problem. (By Robert Lipp. John D. Constance, 625 Hudson Terrace, Cliffside Park, N. J., 1959. Various pagings, paper. $3.50.)

Covered Bridges of the Middle Atlantic States

Using state maps, individual listings, and many photographs of existing spans in each of the Middle Atlantic states, this book describes covered bridges past and present. Emphasis is on historical events and anecdotes related to the bridges. One chapter deals with engineering developments, and a table of specifications of existing covered bridges is included. (By Richard Sanders Allen. The Stephen Greene Press, Brattleboro, Vt., 1959. 120 pp., bound. $6.50.)

Engineering Economics for Professional Engineers' Examinations

The various aspects of engineering economics are reviewed in this text which discusses the media of investment, the time value of money, sinking funds and annuities, valuation of bonds, depreciation and depletion, annual costs, analysis of variable costs, and the legal and business phases of the construction industry. A practical feature is the inclusion of many exercises and problems which illustrate typical questions asked in P.E. examinations throughout the country. (By Max Kurtz. McGraw-Hill Book Company, 330 West 42nd Street, New York 36, N. Y., 1959. 261 pp., bound. $6.50.)

Hydrology
Second Edition

This volume covers stream flow, its fluctuations and their causes, and includes the presentation of a method using the unit hydrograph principle for determining the magnitude of floods that may be expected to occur with specified rare frequencies on any given stream. In this second edition two new chapters on the hydrology of semi-arid basins and the effect of snow on the hydrology of an area have been added. Runoff, precipitation, soil moisture, water losses, ground water, floods, and stream flow records are dealt with; and field problems concerning methods of flood reduction, the evaluation of potential water power on a river, water conservation practices and determination of spillway and bridge discharge capacities are also presented. (By C. O. Wisler and E. F. Brater. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1959. 408 pp., bound. $9.25.)

Isambard Kingdom Brunel

This biography of one of the great engineers of the nineteenth century covers the dramatic and sometimes tragic pioneering events of his life. The building of the Great Western Railway, the first transatlantic steamship crossings, the atmospheric railway fiasco, the construction of the Saltash Bridge, the conflict between Brunel and John Scott Russell, and the final tragedy of the *Great Eastern* are among the happenings described. These historical events of the Industrial Revolution are made more memorable by the portrayal of the magnetic personality of Brunel himself. (By L. T. C. Rolt. St. Martin's Press, 103 Park Avenue, New York 17, N. Y., 1959. 345 pp., bound. $6.00.)

Open-Channel Hydraulics

Discussing flow in open channels and their related structures, this volume covers not only the fundamentals of the subject, but also most of the advances that have occurred in this field during the past ten years. Current American practice is dealt with primarily, but foreign practice is included where useful. The material contained is divided into five parts dealing with basic principles, uniform flow, varied flow, rapidly varied flow, and unsteady flow. The treatment is restricted primarily to flow of water in channels where the water contains little foreign material. (By Ven Te Chow. McGraw-Hill Book Company Inc., 330 West 42nd Street, New York 36, N. Y., 1959. 680 pp., bound. $17.00.)

Principles of Analog Computations

Designed for the user of analog computers, this volume presents those methods of analog computation which form the fundamental tools for the analyst working in the field. With primary emphasis on the types of problems that can be solved, such topics are discussed as problem planning and programming, simulation of linear systems, the use of diodes in analog computations, function relays, implicit-function techniques, and arbitrary function generators. (By George W. Smith and Roger C. Wood. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 234 pp., 1959. bound. $7.50.)

Library Services

Engineering Societies Library books, except bibliographies, handbooks, and other reference publications, may be borrowed by mail by (the Society's initials, eg. ASCE) members for a small handling charge. The Library also prepares bibliographies, maintains search and translation services, and can supply a photoprint or a microfilm copy of any items in its collection. Address inquiries to R. H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N. Y.

Principles of Geology

A text that concentrates on the analysis of processes at work upon and within the earth, instead of presenting a catalog of descriptive facts and terms. This revision incorporates many of the significant advances in geologic science made in the last seven years, and many of the chapters have been rewritten and reorganized. (By James Gilluly and others. W. H. Freeman and Company, 660 Market Street, San Francisco 4, Calif., 1959. 534 pp., bound. $7.50.)

Street Cleaning Practice
Second Edition

A completely revised edition of a work first published in 1938. Serving as a practical manual on municipal street cleaning, it covers methods and equipment, local conditions affecting street cleaning, antilittering campaigns, catch basin and inlet cleaning, snow and ice control and removal, and the organization and management of the street cleaning agency. An extensive appendix summarizes the street cleaning practices of 100 cities in the United States and Canada. (Prepared by the Street Sanitation Committee, American Public Works Association. Public Administration Service, 1313 East Sixtieth Street, Chicago, Ill., 1959. 424 pp., bound. $7.00.)

Structural Design for Dynamic Loads

An outgrowth of a program held at the Massachusetts Institute of Technology, the papers

(Continued on page 122)

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Applications for Admission to ASCE

Nov. 28, 1959-Jan. 2, 1960

Applying for Member

James Henry Adams, Jr., Richmond, Va.
Erasmo Robespierre Ambrioso, Birmingham, Ala.
Richard Ernest Anderson, Washington, D. C.
Octavio Mello Areas, Denver, Colo.
Douglas Clark Atkins, Ft. Riley, Kans.
Miklos Baltay, Burwood, N.S.W., Australia
Justin Anthony Bettendorf, Trenton, N. J.
Philip Hale Bowen, Sacramento, Calif.
Wesley John Brown, Fort Lewis, Wash.
Louis Avon Browning, Atlanta, Ga.
Donald Arthur Buck, Mercer Island, Wash.
Ernest A. Burti, Pittsburgh, Pa.
Robert Henry Butte, Salem, Ore.
Frank Cardile, New York, N. Y.
Frederick George Charlton, Selangor, Malaya
Donald John Cier, Girard, Ohio
Herbert Clark, Jr., Indianapolis, Ind.
Frederick James Clarke, Fort Leonard Wood, Mo.
Robert Raymond Clemens, St. Paul, Minn.
George R. Collier, Galveston, Tex.
Fred Etter Cornwell, Denver, Colo.
Bill Curphy, Dallas, Tex.
Vernon Goodwin Donlin, Santa Fe, N. Mex.
Michael Earnest Doyle, III, East Point, Ga.
Herbert Emil Dux, Hancock, W. Va.
Stavros John Economou, Athens, Greece
Hans Adolf Feibusch, San Francisco, Calif.
John Edwin Francis, New York, N. Y.
Prentis Max Frye, Chattanooga, Tenn.
Charles Frederick Fuechsel, Washington, D. C.
Ralph Frederick Gallogley, Philadelphia, Pa.
Jose Maria Garnica Navarro, Malaya
Earl Theodore George, Jr., Baton Rouge, La.
Francis Martin Henderson, Christchurch, New Zealand
Riby James Hickenlooper, Denver, Colo.
Edgar Benton Hickey, Fresno, Calif.
Paul Shaw Higginbotham, San Francisco, Calif.
Abraham David Horn, Hartford, Conn.
James Quimby Hossack, Omaha, Nebr.
Hulette Hall Huckeba, Atlanta, Ga.
Fred Marcel Hudson, Auburn, Ala.
Vytautas Izbickas, West Roxbury, Mass.
Stanley Tage Birger Johnson, Baltimore, Md.
Irving Kett, Babylon, N. Y.
Myung Soo Kim, Seoul, Korea
Hugh Stuart Geddes Knox, Trenton, N. J.
Sidney Laibson, Hartford, Conn.
Leland LaMont Lawrence, Jr., Tucson, Ariz.
George Joseph Leskowitz, New York, N. Y.
Klaus Rudolf Ludwig, Los Angeles, Calif.
Richard James Mandeville, Grand Junction, Colo.
Adolf Darlington May, Jr., Canoga Park, Calif.
Horace Alexander McAllister, Jr., Hicksville, N. Y.
Edward Jean McCabe, Franklin Park, Ill.
Richard Thomas McKay, Chicago, Ill.
William Joseph McLay, Philadelphia, Pa.
Charles Henry Moorefield, Columbia, S. C.
Earl Jerome Murphy, Jr., New York, N. Y.
Raman Padmanabhan Nair, Denver, Colo.
Aiden Joseph Naughton, Kapushasing, Ont., Canada
Tamajong Ndumu, Cameroons, West Africa
Ernest Jacob Neugroschl, Cleveland, Ohio
Svend Hutzelsieder Nielsen, Riverside, Calif.
James Newell O'Gorman, New York, N. Y.
Donald Clark Parsons, Pittsburgh, Pa.
Robert Combles Paterson, Cheshire, England
Linwood Birdell Pinkham, Augusta, Me.
McGlone Price, Atlanta, Ga.
John Elwood Priest, Lahore, Pakistan
Eugene Nil Proserski, New York, N. Y.
Satyabodh Amrit Punde, Bombay, India
Hakon Gunnar Rasmussen, Philadelphia, Pa.
James Robert Rettie, Winnipeg, Manitoba
Ronald George Albert Richardson, Port Macuarie, N.S.W., Australia
Lawrence M. Rosner, Chicago, Ill.
Habbib Rex Shama, Washington, D. C.
Robert Kenneth Shimer, Chester, Pa.
Alam Singh, Jodhpur, India
Pritam Singh, Jagadhri, India
John Bower Skilling, Seattle, Wash.
John Philip Smith, Jr., Washington, D. C.
Mildred Evelyn Smith (Mrs.), Boulder, Colo.
Donald Martin Sullivan, Boston, Mass.
Cecil Albert Thomas, Boise, Idaho
Ewout van Walsum, Quebec, Canada
Horace Lee Welliver, Buffalo, N. Y.
Donald Erwin Westover, San Francisco, Calif.
Oscar Terrell Williams, Jr., Fayetteville, Ark.
Roy Lee Wright, San Mateo, Calif.

Applying for Associate Member

Daniel Benjamin Acciani, New York, N. Y.
Arunachalam Kulathu Aiyer, Urbana, Ill.
Roger William Algee, Lakeside, Calif.
Gerald Alvarez, Cleveland, Ohio
Hansraj Girdharlal Ashar, Columbus, Ohio

(Continued on page 122)

Wade Ross Baggette, Sr., Dubach, La.
Eduardo Basso, Pasadena, Calif.
Jose' Alfredo Buil, Mobile, Ala.
James Enoch Caffey, Arlington, Tex.
William Garfield Capel, Jr., Philadelphia, Pa.
John Chi-Keung Choi, Berkeley, Calif.
Edward Seabury Coffin, Augusta, Me.
Robert Andrew Crist, Jr., Albuquerque, N. Mex.
August Hoffman Douglas, Jr., New Orleans, La.
Dario Fernandez-Arcila, Cambridge, Mass.
Jerome Lenard Fine, Laurelton, N. Y.
Paul Fitzgerald, Baltimore, Md.
Robert Hudson Gibson, Warren, Mich.
Raul Grimaldi-Bortot, Caracas, Venezuela
John Richard Grindel, Notre Dame, Ind.
Joseph Earl Helton, Dallas, Tex.
Dale Charthel Hemphill, Pittsburgh, Pa.
Lawrence Irwin Jacobs, III, Palo Alto, Calif.
Joseph Lee Johnson, Kansas City, Mo.
John Sherman Lathrop, Jr., La Crescenta, Calif.
Harold Dale Laverentz, Kansas City, Mo.
Cheng Yung Liu, New York, N. Y.
Kamran Majidzadeh, Urbana, Ill.
Gerald Riordan Manning, Pittsburgh, Pa.
Garnet Roy Martin, Curepipe, Mauritius
Lowell Flemming McGee, Pittsburgh, Pa.
John Albert McLaughlin, San Francisco, Calif.
Raymond Perry Miller, Urbana, Ill.
Vincent Joseph Miller, Deland, Fla.
Abdu Mohamed Abdu, Evanston, Ill.
Abdullahi Mohamed Ibrahim, Wad Medani, Republic of the Sudan
Hector Manuel Morales, Rio Piedras, Puerto Rico
Frederico Nachticall, Buenos Aires, Argentina
Thomas Joseph Nakley, Youngstown, Ohio
Anantanarayanan Krishnaswamy Narasimhan, Boulder, Colo.
Pulikkottil Ukkru Paul, Troy, N. Y.
Rodnye Hutchinson Resta, Hyattsville, Md.
Walid Hasan Rimawi, Evanston, Ill.
Maurice Delano Roos, Sacramento, Calif.
Anatol Rychalski, Chicago, Ill.
James Ray Scott, Dallas, Tex.
George Seaden-Kowalski, Quebec, Canada
Kenneth Alvin Selby, Toronto, Ont., Canada
Evelyna Bloem Souto Silveira, Sao Paulo, Brazil
Arthur Vernon Strock, Miami, Fla.
Rajagopala Ayyar Sundaram, Cambridge, Mass.
Vasant Hargovindas Surti, Lansing, Mich.
Olaf Tabur, Dillsburg, Pa.
Jeff Lee Taylor, Fresno, Calif.
Roberto Andrade Teixeira, Urbana, Ill.
Leonard Joseph Timms, Jr., Tulsa, Okla.
William Allen Toomey, Sacramento, Calif.
James Charles Trump, Valparaiso, Ind.
Mehmet Taner Tumay, Charlottesville, Va.
Umesh Chandra Vasishth, Olympia, Wash.
Lewis van Niekerk Vink, Cape Province, South Africa
Frank G. Waldraff, Bethlehem, Pa.
Solomon Wolfus, Los Angeles, Calif.
Liu Yu, Brookings, S. Dak.

[*Applications for the grade of Associate Membership from ASCE Student Chapter Members are not listed.*]

Recent Books

(Continued from page 120)

included are concerned with a more precise evaluation of the effects produced by the dynamic portion of the loading in structural design. Those aspects considered include behavior of materials under dynamic loading, calculation of response of structural systems to dynamic loading, modern computational techniques applicable to response calculations, and the application of structural design and analysis to specific cases involving dynamic loading. Concluding sections summarize the current thinking on earthquake resistant design, and discuss the vibration of girders under traffic loads and the dynamic effects of wind loads. (By Charles H. Norris and others. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1959. 453 pp., bound. $12.50.)

Turbulence

The current concepts and theories relating to turbulent fluid flow are presented in such a fashion as to form a basis for advanced studies in this field. The author begins with a general introduction to turbulence theories and derives the basic formulas used. This is followed by a description of the methods and instruments used in measuring turbulence qualities, of the generally accepted theories of isotropic turbulence, and of attempts to arrive at a statistical theory of nonisotropic turbulence. An extensive study of transport properties is then followed by nonisotropic free turbulence and turbulent flow along fixed walls. (By J. O. Hinze. McGraw-Hill Book Company, Inc. 330 West 42nd Street, New York 36, N. Y., 1959. 586 pp., bound. $15.00.)

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

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These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 percent of the first year's salary if a non-member, or 4 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

Men Available

PROJECT ENGINEER, M. ASCE, B.A., M.S., married, large family. Fifteen years of construction engineering and management experience including Far North, general building, waterfront, power plant, water supply. Location preferred, Overseas, West Coast or South. Salary, $10,000 minimum. C-511.

CIVIL ENGINEER, M. ASCE, registered in California, B.S. in C.E.; 34; 10 years of broad civil and mechanical engineering in managerial, supervisory and design positions. Desires responsible position with definite growth possibilities. Prefers South but will relocate to any promising location. C-512.

CIVIL ENGINEER, M. ASCE, Professional Civil Engineer License in Pennsylvania; B.S.C.E.; 28; two years on installation engineering with USAF, and four years on railroad maintenance and construction. Location preferred, Kentucky, Indiana, Ohio. C-513.

RESIDENT ENGINEER, M. ASCE, registered P.E. (2 states), B.S.C.E.; 36; six and a half years of experience in responsible supervisory positions on multimillion dollar bridge, highway and building construction for consulting firms; and 8½ years in private practice. Experienced in general land surveying, subdivision planning and design, demolition of buildings and houses, house moving and construction. C-514.

DIRECTOR OF ENGINEERING, VICE PRESIDENT, F. ASCE. Outstanding 18-year record in administration of design and construction of complex industrial projects, as well as heavy construction projects including important earth and concrete dams, docks, bridges, missile bases and technical facilities. Eminent professional and academic background. Location preferred, West Coast. C-515.

STRUCTURAL DESIGNER OR FIELD ENGINEER, A.M. ASCE, M.S. in C.E.; 30. Three consecutive summers as supervisor of reinforced concrete construction work, design office work in sewerline layout and lagoon, and as a research assistant at University of Missouri determined physical properties of soils. Location preferred, East or West Coast. C-516.

CIVIL ENGINEER, A.M. ASCE, B.S.C.E.; 31. Six years of experience in construction, surveying, quality control, designing and estimating. Speaks Spanish. Location preferred, Foreign or southern U.S. C-517.

SALES OR SERVICE ENGINEER, A.M. ASCE, B.S.C.E.; 26. In engineered building materials field for 1½ years doing structural design, product development, pricing, quoting, servicing and sales for industrial accounts. Will relocate. C-1027-Chicago.

GENERAL SUPERINTENDENT, ESTIMATOR, A.M. ASCE; 29. Project engineer on large airbase project; general superintendent and superintendent on asphalt, base, dirt and concrete paving; estimating, bidding and pre-bid job site investigation on Government, State and municipal projects. Will relocate. C-1028-Chicago.

CHIEF SANITARY ENGINEER, A.M. ASCE, B.S., M.S.; 55; for consulting engineering firm. Fully versed in all phases of design of sewerage, sewage treatment and water purification facilities and related projects. Minimum salary, $12,000 a year. Location preferred, East or Midwest. C-1030-Chicago.

FIELD ENGINEER, A.M. ASCE, Registered E.I.T., B.S.C.E., M.S.C.E.; 29. One year on highway location and construction surveys; three years as assistant soils engineer including all phases of preparation and execution of test boring work. Military service completed. Location preferred, Detroit or vicinity. C-1036-Chicago.

PROJECT ENGINEER, M. ASCE, registered, M.S.C.E.; 33. Experienced in initial layout; economic justification and design of projects; supervision of drawings, specifications, contract documents, and administration to "operational" in chemical and utilities. Experience includes mechanical phases, administrative, supervision, basic design and drafting in office and on job. Location preferred, South or East.

PROJECT ENGINEER-DESIGNER, M. ASCE, A.B., B.S.C.E., M.S.C.E.; 33. Resident engineer and field engineer for 2 years on highway bridge and other public works projects, three years on structural design and specifications for bridges and buildings of steel, reinforced concrete and timber. C-1038-Chicago.

CONSTRUCTION SUPERINTENDENT, M. ASCE, 60. Thirteen years of experience with architects, engineers and public utilities, supervising construction of chemical processing buildings, sewage pumping plants, AEC projects, public utility projects. $6,600 a year. Se-102.

MATERIALS ENGINEER OR INSPECTOR, M. ASCE, C.E., 31. Five years of experience laboratory test of materials, soil surveys, design, inspector on highway and bridge construction. $10,000 a year. Location preferred, South America or Overseas. Se-1687.

STRUCTURAL ENGINEER, M. ASCE, M.S.C.E., 30. Seven years of experience on design of industrial buildings, power plant, transmission lines, bridges, foundations, prestressed concrete and steel structures; including three years on construction. $7,800 a year. Location preferred, San Francisco. Se-1686.

SANITARY-STRUCTURAL ENGINEER, M. ASCE, B.S. in structural engineering, M.S. in sanitary engineering, 34. Nine years diversified experience with consulting firms. Good record of supervision, ability to contact government and city officials, foreign and domestic. Will travel. $10,200 a year. Location preferred, West or Foreign. Se-1745.

FIELD OFFICE ENGINEER, A.M. ASCE, licensed Civil Engineer in Iowa, C.E., 31. Seven years as superintendent, designer on bridges, earth dams, pavement, drainage for highway department and heavy construction; three years with the Navy on maintenance of utilities, grounds, housing and structures. $10,000 a year. Location preferred, South or West. Se-1671.

STRUCTURAL DESIGN DRAFTSMAN, A.M. ASCE, C.E., 58. For 13 years had own firm and acted as a consultant on industrial buildings of steel, timber, masonry, crane girders, gantry structures, retaining walls, foundations, etc.; nineteen years' estimating, detailing, design, fabrication, erection, miscellaneous iron. Salary open. Location preferred, San Francisco Bay Area. Se-1546.

PROJECT MANAGER, F. ASCE, licensed CE in California, 30. Ten years of experience supervising research, investigations, reports, preliminary plans, electronic data processing, office and field on municipal waste disposal, and for seven years was Army communications officer. $10,800 a year. Location preferred, California or West.

STRUCTURAL DESIGNER, M. ASCE, C.E. (Europe), 36. Experienced on design of steel, reinforced con-

crete bridges, industrial structures, buildings, tunnels, prestressed concrete design. $8,100 a year. Location preferred, San Francisco. Se-1667.

PROJECT ENGINEER OR COORDINATOR, A. ASCE. Registered Civil Engineer, B.S., M.S.C.E., 30. Five years of experience on structural design, supervision, checking shop drawings, inspection, client liaison for consulting engineer. Desires increasing administrative responsibilities. $9,000 a year. Location preferred, San Francisco Bay Area. Se-1644.

STRUCTURAL DESIGNER, A. ASCE, M.S.C.E., 23. For one month designed prestressed floor beams and slabs for consultant on bridge projects, and for 2 years was a teaching assistant and fellow; surveying reinforced concrete labs. One year survey crew chief on roads, for consultant. $6,500 a year. Location preferred, West, Foreign. Se-1601.

Positions Available

CITY ENGINEER, licensed graduate civil, with street and sewer experience; capable of street and treatment plant design. City engineer experience preferred. Apply by letter giving past ten years' experience, references and salary required. Location, Arkansas. W-8428-C.

TOWN ENGINEER, college graduate or equivalent, registered P.E. in New Jersey. Duties will include the supervision of small engineering staff engaged in surveys, preparation of plans and specifications and in construction of streets, sewers, parking plazas, municipal construction; traffic engineering. Salary, $7,600-$10,200 a year. Location, New Jersey. W-8403.

ENGINEERS. (a) Plan examiner (buildings), graduate civil, New York State P.E. license required, with six years of experience in civil engineering design or building construction work. Salary, $7,450 a year to start. (b) Assistant plan examiner, C.E. degree, with three years of design or construction experience. Salary, $6,050 a year. Location, New York Metropolitan area. W-8396.

CONSTRUCTION MANAGER experienced on housing projects. Location, Middle East. F-8392.

CIVIL ENGINEERS. (a) Resident engineer, civil graduate, with at least ten years of supervisory dam construction experience. Salary open. (b) Structural design engineer, civil graduate, with at least eight years of experience on hydraulic structures for irrigation, drainage, canals and hydroelectric projects. Salary, $10,000-$12,000 a year, plus bonuses and living allowance. Location, South America. F-8383.

This is only a sampling of the jobs available through the ESPS. A weekly bulletin of engineering positions open is available at a subscription rate of for members, $4.50 per quarter or $14 per annum for non-members, payable $3.50 per quarter of $12 per annum in advance.

RESIDENT ENGINEER, graduate civil or architectural training, to handle construction and maintenance department of a company operating supermarkets. Will have responsibility for planning construction and layout of new stores and to supervise maintenance in old stores. Eight to ten years of experience in store design and construction, preferably in a supermarket chain; also experience in maintenance activities. Salary open. Location, New York. W-8375.

ENGINEERS. (a) Architectural engineer to head up building program for multi-building of shopping center types. Must have ability to manage completion of work. Some traveling. Salary, $15,000 a year. (b) Construction engineer, experienced in supervising similar building projects. Salary, $8,000-$10,000 a year. Headquarters, East. W-8365.

SANITARY ENGINEER, preferably with post graduate training at a school specializing in sanitary engineering, with three to five years of experience on preparation of reports, detail design and operation of water treatment plants and sewage treatment plants, especially of the activated sludge type. Salary, $6,700-$8,500 a year. Location, eastern Canada. W-8355.

ASSISTANT PROFESSOR for department of civil engineering, PhD., with training and experience in the field of applied mechanics, either solid or fluid. Should be capable of teaching both undergraduate and graduate work in one or more of these areas. Should be capable and interested in doing research; opportunity to develop laboratory and experimental work in area of specialization. Will consider a June 1960 graduate. Salary, from $6,770 for ten months. Position available September 1960. Must be a citizen of U.S. Location, New England. W-8348.

CIVIL ENGINEER, B.S. in civil or sanitary engineering, over ten years of experience in design of water and sewerage facilities; municipal projects, and with knowledge of civil and sanitary engineering; surveying. Will be responsible for the management of the civil engineering department in one of the company's branch offices. Will supervise the work of other engineers and be capable of contacting municipalities and the public in the promotion of new work, for a consulting engineering firm. Car required. Salary, $10,000 a year or more. Employer will pay placement fee. Location, western Illinois. C-7870.

PROJECT ENGINEER, graduate M.E., chemical or structural engineering, eight years' experience in layout, design and construction of cement plants. Must be able to be prime motivator from early stages of planning thru final design and construction of a cement plant. Client contact and promotional activities will be an important phase of applicants' duties for a consultant. Salary, $10,000-$11,000 a year. Employer will pay placement fee. Headquarters, Chicago. C-7848.

EXPORT SALES ENGINEER, graduate C.E. or M.E., five or more years of experience in sale of heavy construction export. Handling expprt sales of heavy construction equipment such as sand washing and paving equipment. Equipment for concrete pipe lines, hoists, etc. May have to take an occasional trip to a foreign country. Salary, about $10,000 plus bonus. Employer pays placement fee. Headquarters, Chicago. C-7846.

CONSTRUCTION SUPERINTENDENT, C.E., recent and substantial experience in field superintendency of general construction with some knowledge of mechanical and electrical. Will represent the principal to all contractors including general and subcontractors. Should understand the trades, carpentry, timbering, electrical, mechanical, and civil and work relating to an extensive rocket launching installation and accessory equipment on a missile base. $10,000-$15,000 a year. Location, San Francisco Bay Area. Sj-4948.

CONSTRUCTION ENGINEER, C.E. or M.E. with previous experience in directing or coordinating plant construction work, preferably with nonferrous smelting plants. $7,200-$10,200 a year. Location, Western U.S. Sj-4928R(b).

News of Members

(Continued from page 25)

William T. Ingram, consulting engineer, with offices at 20 Point Crescent, Whitestone 57, N.Y., has opened a West Coast office at 80 Panoramic Way, Walnut Creek, Calif., with **Fred R. Ingram** as associate in charge of that office. Mr. Fred Ingram brings to the staff a specialist's experience in industrial hygiene and air pollution control.

John F. Brahtz has established the firm, John F. Brahtz Associates, with home offices in Los Angeles, Calif. Previously, Dr. Brahtz was vice president and director of engineering for J. H. Pomeroy and Company, and associate professor of engineering at the University of California.

Tazewell Ellett, of Richmond, Va., has retired as county engineer of Henrico County, Virginia, after twenty-six years in the service of the county. He will continue to serve the county as consultant.

Anthony F. Gaudy, Jr., recently became assistant professor of sanitary engineering at the University of Illinois in Urbana. Dr. Gaudy is completing a research project on the biological treatment of petrochemical wastes under the sponsorship of the U. S. Public Health Service.

Grover C. Haynes has left the Leap Concrete, Inc., of Lakeland, Fla., where he was chief engineer, to open an office at 41 Montford Avenue, Asheville, N. C. Mr. Haynes will maintain a structural and general civil engineering practice.

F. Lionel Peckover recently accepted the newly created position of engineer of soils and foundations for the Canadian National Railways, with headquarters in Montreal. Mr. Peckover for the past six years has had charge of the Canadian portion of the soil engineering section of the St. Lawrence Seaway Authority.

H. W. Slack has been elected a director of Commonwealth Services, Inc., of New York City. Mr. Slack joined Commonwealth Associates, an engineering affiliate of Commonwealth Services, in 1925, and since 1957 has served as its director and vice president.

Eugene P. Richey has been awarded an $8,500 (plus travel expenses, tuition, and fees) National Science Foundation Faculty Fellowship for one year's study in hydraulic engineering at the Technological University at Delft, Netherlands. For four years Dr. Richey taught civil engineering at Washington State College and since 1954 has been at the University of Washington, where he is now associate professor of civil engineering. Also awarded a Foundation faculty fellowship is **James R. Fincher,** assistant professor of civil engineering at the Georgia Institute of Technology. Professor Fincher will use the fellowship for advanced study leading to a Ph.D. degree.

Joseph F. Jelley, Rear Admiral (retired), former chief of the Navy's Bureau of Yards and Docks, has joined Henningson, Durham & Richardson of Omaha, Nebr., as an engineering consultant. Admiral Jelley will make his headquarters in the firm's Colorado Springs office at 121 East Vermijo Avenue.

Laurence B. Kuhns, who joined the Aluminum Company of America, Pittsburgh, in 1924 after graduating from Rensselaer Polytechnic Institute, is returning to his alma mater as chairman of the Architectural Development Council. Since January 1958 Mr. Kuhns has been chief engineer of Alcoa.

Thomas Blench, professor of civil engineering at the University of Alberta, has been awarded the degree of doctor of science by the university. Before joining the staff in 1948 he was director of irrigation research for the pre-Partition Punjab, (India). Through T. Blench & Associates Ltd., Edmonton, Alberta, he conducts a consulting practice on the problems of river engineering, models, special hydraulics, hydrology and reclamation.

Non-ASCE Meetings

American Concrete Institute. Fifty-sixth annual convention at the Commodore Hotel, New York, N. Y., March 14-17. Charles L. Cousins, Public Relations Director, ACI, P.O. Box 4754, Redford Station, Detroit 19, Mich.

American Institute of Mining, Metallurgical and Petroleum Engineers. Annual convention at the Statler Hilton and Sheraton-Atlantic Hotels, New York, N. Y., February 14-18. AIME, 29 West 39th Street, New York 18, N. Y.

American Power Conference. Twenty-second annual meeting sponsored by the Illinois Institute of Technology at the Hotel Sherman, Chicago, Ill., March 29-31. R. A. Budenholzer, Conference Director, Mechanical Engineering Department, Illinois Institute of Technology, 3300 Federal Street, Chicago 16, Ill.

American Water Works Association. Eightieth annual conference at Bal Harbour, Fla., May 15-20. Conference headquarters will be the Hotel Americana. Raymond J. Faust, Secretary, AWWA, 2 Park Avenue, New York 16, N. Y.

Associated General Contractors of America. Forty-first annual convention at the Masonic Memorial Temple, San Francisco, Calif., March 21-24. For hotel reservations contact William G. Dooly, Manager, Public Relations and Publications, AGC, 20th and E Street, N. W., Washington 6, D. C.

Chamber of Commerce of the United States. National construction industry conference at the Chamber Building, Washington, D. C., March 10-11. Construction and Civic Development Department, Chamber of Commerce of the United States, 1615 H Street, N.W., Washington 6, D. C.

Highway Geology Symposium. Eleventh annual meeting in the auditorium of the Geology Building of the Florida State University, Tallahassee, Fla., February 26. Dr. W. F. Tanner, Associate Professor, Department of Geology, Florida State University, Tallahassee, Fla.

Illinois Highway Engineering Conference. Forty-sixth annual meeting at the University of Illinois, Urbana, Ill., February 23-25. John W. Hutchinson, Assistant Director, 304 Civil Engineering Hall, University of Illinois, Urbana, Ill.

Illinois Traffic Engineering Conference. Twelfth annual meeting at the University of Illinois, Urbana, Ill., February 25-26. John E. Baerwald, Director, 401 Civil Engineering Hall, University of Illinois, Urbana, Ill.

International Construction Exhibition. Second International Exhibition at the Palace of the National Industrial and Technical Center, Paris, France. Exhibition Secretariat, ICE, 1, Avenue Niel, Paris XVII, France.

Louisiana State University. Twenty-third annual short course for superintendents and operators of water and sewerage systems at the University, Baton Rouge, La., March 16-18. Fred H. Fenn, Dean, College of Engineering and Director, Engineering Experiment Station, Louisiana State University, Baton Rouge, 3, La.

National Society of Professional Engineers. Winter meeting at the Broadview Hotel, Wichita, Kans., February 18-20. Kenneth E. Tombley, NSPE, 2029 K Street, N.W., Washington 6, D. C.

North Carolina State College. Ninth annual municipal and industrial waste conference on the State College campus, Raleigh, N. C. Division of College Extension, P. O. Box 5125, State College Station, Raleigh, N. C.

School of Engineering of the College of the Pacific. Third annual highway conference on campus at Stockton, Calif., March 1-3. Adelbert Diefendorf, Dean, School of Engineering, College of the Pacific, Stockton, Calif.

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

New Core Drill

A RUGGED, HEAVY-DUTY core drill specifically designed and built to either core down to depths of 4500 ft or operate as a rotary drill to depths of 1500 ft, has been made available.

In the designing of this rig, The Acker Presidenté, close attention was given to features essential to simple, efficient and economical operation. For example, all controls are arranged in a single group for operator convenience. The hoist is oversized and power operated. An automatic chuck (optional at extra cost) speeds up rod handling. The rugged steel drill head is hydraulically operated with powerful heat-treated forged-steel drive gears. **Acker Drill Co., Inc., CE-2, P.O. Box 830, Scranton 2, Pa.**

Infra-Red Heaters

INSTANT INFRA-RED HEAT that warms the man and the job but not the air is possible with new portable gas-fired infrared radiant heaters, according to the manufacturer.

Operated outdoors or in on bottled propane gas, the heaters produce sunshine-like warmth at low cost. Because infra-red rays, like rays of light, can be directed and controlled easily, they can be concentrated on specific areas by polished parabolic reflectors without heating the surrounding air. Workmen, tools and material remain comfortably warm even when the temperature falls to zero or below.

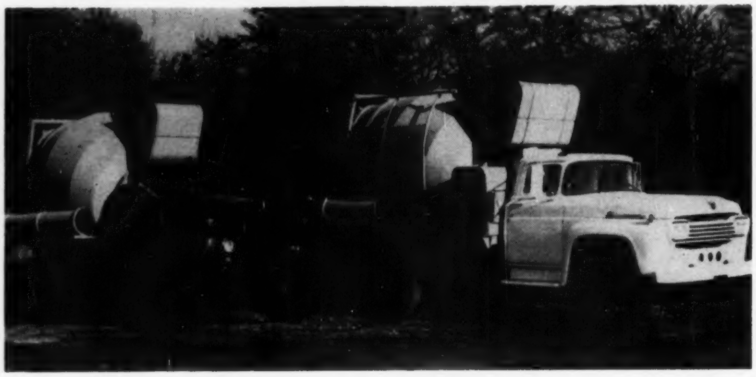
Infra-red rays are produced by burning the gas on the surface of a ⅜-in. thick perforated ceramic mat containing 200 holes per square inch. The ceramic is a near-perfect insulator and is the most efficient gas generator of infra-red heat energy ever developed, the company states. **Perfection Industries, Division of Hupp Corp., CE-2, 1135 Ivanhoe Road, Cleveland 10, Ohio**

Level Luffing Gantry Crane

A CRANE AS TALL as a 20-story building and weighing 325 tons has been installed in Port Weller, Ontario, to aid Great Lakes shipping on the St. Lawrence Seaway. Equipped with its own diesel electric power plant, the crane's 140-ft boom can lift a maximum of 55 tons.

Port Weller Dry Docks Limited, owners of the new level luffing gantry crane, built a heavy duty railway track extending 2,000 ft from their building berth to the fitting-out berth to take maximum advantage of the mechanical giant, which moves along the track on 16 wheels, each 27 in. in dia. **Provincial Engineering, Ltd., CE-2, Niagara Falls, Ontario, Canada.**

Modern Design for Concrete Mixers



THE COMPANY INTRODUCES "swept back styling with a purpose" in concrete mixers with its new line of Fleetmaster and Fleetbuilder Truck Mixers.

The center of gravity has been moved forward up to 16 in. in all models, thereby permitting the user to haul more concrete legally than in previous years; the streamlining is a definite function of this forward shift of weight. The improved center of gravity characteristics stem from several factors. The company has replaced the conventional round type water tank with one of a swept back triangular design. Its slope follows that of the mixing drum and makes it possible to move the drum forward up to 16 inches.

A change from the familiar channel to pipe construction in the rear support frame not only lends to the modern design, but it provides important weight saving with no loss in strength.

Other major improvements embodied in the new line include a socket mounted trunnion bearing which distributes thrust equally throughout the frame, a standardized enclosed front end take off box to fit all trucks without adjustment and the offering of two transmissions. **Worthington Corporation, CE-2, Harrison, N. J.**

Pipe Pushers Redesigned

MAJOR DESIGN CHANGES in their fully powered "Speed-Thru" pipe pushers have been announced by the company. The new pushers, which come in three sizes capable of gripping up to 4 in. I.D. pipe, and with thrusts up to 110,000 lb, are now in production, in time for the winter season and frozen ground installations. The shorter stroke, according to company engineers, serves to increase speed, provides easier handling due to the shorter length and lighter weight, and creates greater strength in the structural design.

Field engineers for "Speed-Thru" claim that high pressure tests in the field with the new models showed increased pushing accuracy and a complete elimination of upward or side movements of the pushing unit, even under the most severe thrust conditions.

Other features include a non-crushing, self-gripping and releasing pipe clevis, wider trackage for the thrust carriage wheels and a 20% increase in operating pressures over the original models. **Mercury Hydraulics, Inc., CE-2, 1632 Wazee St., Denver 2, Colorado**

New Drawing Instrument

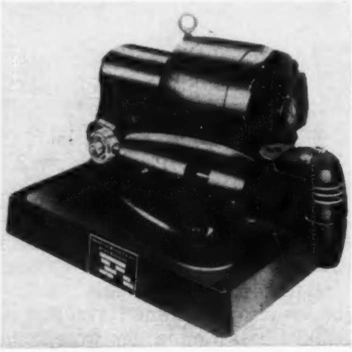
COMBINING THE ADVANTAGES OF a protractor, straight edge, and scales in one instrument, the Draft-All Triangle can be used to construct complete mechanical drawings. Permanently stamped into a standard 8 in., 45/90-deg plastic triangle are the four popular scales—1 in., ¼ in., ⅛ in. and $\frac{1}{10}$ in. as well as guide lines for construction of 90 deg, 75 deg, 60 deg, and 30 deg line intersections. Easily stored or carried, it is ideal for off-the-board drawings, field work, or for individuals who make occasional drawings, but do not have regular drafting equipment facilities. **Draft-All Triangle Co., CE-2, 152 W. 42nd St., New York 36, N. Y.**

EQUIPMENT MATERIALS and METHODS

(continued)

Chemical Feed Pumps

PRODUCTION HAS BEGUN ON 200 Series Controlled capacity pumps, which have a repetitive metering accuracy of $\pm 1\%$. The Simplex pumps have a capacity of 812 gph and the Duplex pumps have double this capacity. The new pumps have a self-contained lubricating system that makes it unnecessary to shut down the pump for lubrication.



Self-Contained Lubricating System

Liquid ends made from various alloys are easily interchangeable in the field at minimum cost. E-Z Clean cartridge valves simplify and minimize maintenance operations. With this type of liquid end, it is unnecessary to disconnect piping to clean or inspect valves.

The controlled capacity pumps move specific volumes of fluid, including "tough", corrosive materials, into high or low pressure systems in virtually all desired ratios, with flow, temperature, pressure, conductivity, PH and other process variables. **American Meter Pump Division, CE-2, 13500 Philmont Ave., Philadelphia 16, Pa.**

Sander-Grinder Power Units

TWO NEW UNITS OF high speed industrial sander-grinder power units have been introduced. They are the Model 539 recommended for use with 9-in. discs and wheels and the Model 540 recommended for use with 7-in. discs and wheels.

There are many industrial applications for these new sander-grinders such as welding shops, foundries, galvanizing plants, steel mills, machine shops, paper mills, garages, body shops and factory maintenance. Contractors find the sander-grinders ideal for grinding down cement seams and cleaning metal concrete forms.

(Continued on page 132)

EQUIPMENT MATERIALS and METHODS

(continued)

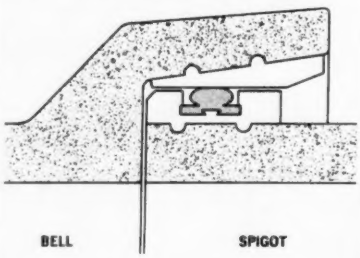
These tools are built with magnesium alloy housings to provide extra toughness without adding extra weight. Large ball bearings throughout and hardened spiral bevel gears give trouble free operation even under the most abusive conditions. Comfortable rear handle incorporates large trigger switch for extra safety. Convenient auxiliary hand grip can be placed on either side of gear housing for easy control at any angle. A push button lock on the spindle makes changing discs a fast simple operation. A removable side fitting offers easy lubrication. **Porter-Cable Machine Co., CE-2, 112 Seneca St., Syracuse 4, New York**

Vitri-Seal Joint

Natco clay sewer pipe is now available with Vitri-Seal joints, a compression type seal that is self-aligning, leak-proof, resilient, acid and alkali resistant, and root-proof.

The joint consists of polyester fixed rings in the bell and on the spigot ends, and a specially designed flexible rubber

STRONG and TIGHT IN HOME POSITION



"O" ring which acts as the seal. The rubber gasket maintains a tight seal all around the socket under high shear stresses. The joint conforms to all requirements of ASTM Specifications C13—for Standard Strength Clay Pipe or to Specification C200—for Extra Strength; and to Type 111 of Specification C425-58T, for Pipe Joints Having Resilient Properties. **Natco Corporation, CE-2, 327 Fifth Ave., Pittsburgh 22, Pa.**

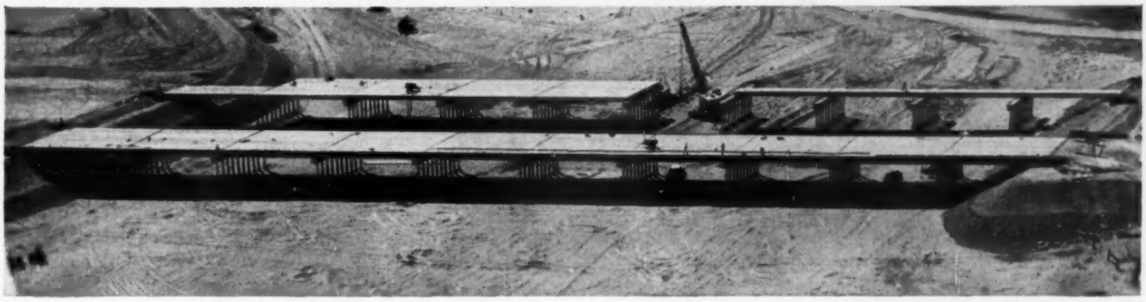
Curing Agent and Seal

A combination curing agent and seal for new concrete floors, trade named Tremcrete, has been announced.

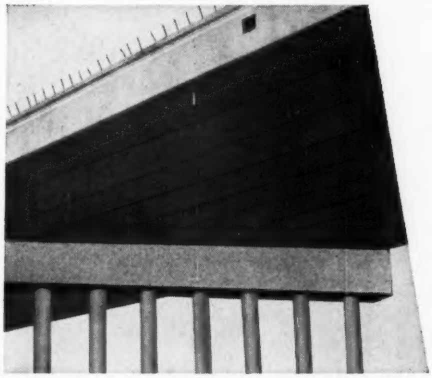
Tremcrete saves labor cost by eliminating constant wetting down of concrete during the curing stage, also the use

(Continued on page 134)

AMDEK Bridge Beams
speed superhighway construction



Dual lane highway bridges, constructed with prestressed pretensioned Amdek Beams, near completion in Socorro County, New Mexico. Erected for the New Mexico State Highway Department as part of the Federal Interstate Program.



Low depth-to-span ratio means less weight, greater clearance and reduced fill. Smooth underdeck offers minimum resistance to flood debris.

Another example of
Progress in Concrete

Amdek Superstructures—available in lengths up to 100 feet or even more—can cut bridge building time from weeks to days or days to hours! Prestressed, pretensioned, and with specially designed voids, Amdek Sections are lighter and more rigid for better, easier handling . . . provide a stronger combination deck and loading member.

Precast Amdek is rapidly placed in any weather and assures a bridge of beauty for years without painting or other maintenance. Materials are readily available . . . plants are strategically located for fast delivery anywhere—to bring you "Tomorrow's Bridge" today.

American-Marietta's experts in the design and manufacture of prestressed and precast concrete bridge members—including Amdek, I-Beams and Channel Slabs—can help *you* save considerable time and money.

200 Amdek Box Girders used to build 506 foot bridges on 30° skew. Independent dynamic and static load tests prove superior strength of Amdek Skew Beams.

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EQUIPMENT MATERIALS and METHODS

(continued)

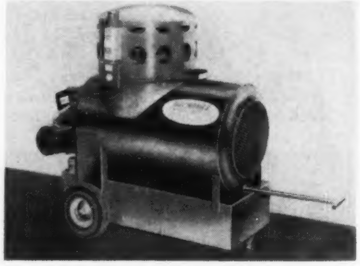
of messy straw, burlap or paper. And being a two-in-one product requires less labor which means less cost.

In one application, this new product provides a high degree of water retention in the concrete while the proper cure takes place. It also exhibits superior abrasion resistance while the building is being completed and for some time after. Tremcrete permits application of paint, linoleum and asphalt tile directly on the floor as soon as construction is finished and before tenants move in. **Tremco Mfg. Co., CE-2, 10701 Shaker Blvd., Cleveland 4, Ohio.**

All-Purpose Portable Heater

An all-purpose portable heater, which is adjustable to any output—up to 400,000 BTUs, the Electro-Jet requires only a nozzle adjustment to vary the heat for any requirement.

The heater features push-button control; it lights instantly and produces up to 500 deg of heat in 70 sec. A special thermostat maintains the desired temperature, and a limit control automatically shuts off the unit should the fan quit for any reason. The fully automatic oil burner uses No. 1 or 2 fuel oils. The removable double-wall insulated stainless steel combustion chamber can be replaced in ten minutes. The fan, powered by a $\frac{1}{3}$ hp GE thermal overload motor, delivers up to 2500 cu ft of hot air per minute. Mounted on 10x2.75 semi-pneumatic tires, the unit has removable tow bar for easy handling. **Electronics, Inc., CE-2, Vermillion, South Dakota.**

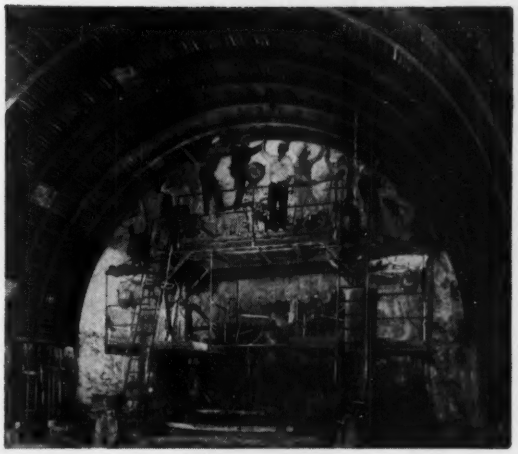


Push-Button Control

New Relief Maps

New three-dimensional views of the World and United States, showing the shape of the land as it really is, have

(Continued on page 136)



INSIDE FLANGES of liner plates are bolted to the web of arch ribs. Erection of components is fast; fit is certain; and joining with quick-acting, coarse threaded bolts is positive and rapid.

TUNNEL PORTAL for two-lane vehicular traffic through mountainous San Gabriel Canyon.

"SAFETY FOR TRAFFIC" is spelled out in extra strength of COMMERCIAL's tunnel support system. Note: Posts set in unsupported roof section to receive future arch support as conditions may require.

How to Support Rock Tunnels in Earthquake Area

A major 10-tunnel highway project through a 6500 ft. mountainous terrain will soon speed up shipment of products from Antelope Valley to the nearby, fast growing Los Angeles market. Highway authorities have noted that motorists driving through those tunnels already completed in this frequently earth tremored area have a sense of safety reassurance due to the solid protective appearance of the exposed steel tunnel support system.

To keep the project rolling on schedule, the Los Angeles County Highway Department has specified COMMERCIAL steel ribs and liner plates. They know from past experience on other tunnel projects that all fabricated parts–ribs, liner plates, wall beams, posts and bolts –arrive on the job accurately fabricated to quickly "button up" the COMMERCIAL tunnel support system.

Fast erection of the steel supports in sections of the new 34 ft. wide, 2-lane tunnels is mighty important, too. Arch ribs and plates, sized for easy handling, are raised by a cable sling on a power shovel and set by crews working from a drilling jumbo. Two-piece arch ribs are placed with staggered joints at the crown. Liner plates have corrugations to give them added strength for lagging and their continuous inside flanges are bolted to the web of the ribs.. spaced on 3 ft. centers.

Back-packing is placed to fill all voids between the excavated rock and the liner plate lagging. Then grouting is pumped to fill all small voids in the back-packing. Thus, uniform loading is placed on the entire arch.

The full advantages of any COMMERCIAL tunnel support system start with COMMERCIAL's engineering assistance. With 35 years experience, they may well be able to help you speed up and simplify your next tunnel job, whether vertical, surface, sub-surface, soft or hard ground. For complete details, please write to Commercial Shearing & Stamping Company, Dept. C-6, Youngstown 1, Ohio.

COMMERCIAL
shearing & stamping

EQUIPMENT MATERIALS and METHODS

(continued)

been published. Both of the 28-in. x 18-in. plastic maps, the first to be produced in this size it is stated, show mountains and valleys in detailed relief that stands up nearly a half inch.

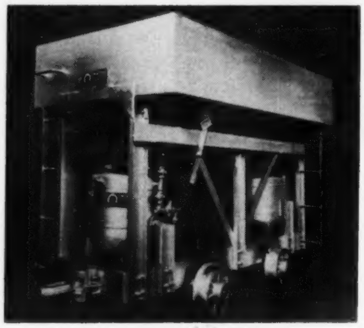
The detailed 50-state U.S. map shows 4,000 geographic names, including 2,000 cities and towns, 1,000 rivers and lakes, 150 national parks and monuments, and over 200 mountain ranges and peaks. Its scale is 117 miles to the inch.

The companion World relief map features nearly 2,500 place names, which includes 1,200 cities and towns, 400 large bodies of water, 450 islands, mountain ranges and peaks. The map scale is 962 miles to the inch. **Aero Service Corporation, CE-2, 210 East Courtland St., Philadelphia 20, Pa.**

Pea Shooter Car

A NEW PEA SHOOTER CAR injects pea gravel into the tail void formed by advancing the tunnel shield.

Designed to pass through lock doors. the first use for the machine is in the Second Boston Harbor Tunnel. The car, which has a capacity of 4 cu yd, is loaded outside the tunnel and moved in



4 Cu Yd Capacity

behind the shield when the crew is ready to shove. Gravel flows by gravity from the hopper down into the two pea shooters on the car and is injected through hoses into the tail void. At the conclusion of the shove, the car is backed outside the tunnel and re-loaded until it is required again. **Mayo Tunnel and Mine Equipment, CE-2, Lancaster, Pa.**

Welder and Power Unit

A NEW GASOLINE ENGINE driven combination arc welder and power unit,

(Continued on page 138)

EQUIPMENT MATERIALS and METHODS

(continued)

designed especially as a source of power for tungsten-inert-gas-shielded arc welding in the field where normal power is not available, has been announced.

The unit has only one engine and only one generator, yet provides current for either AC welding or DC welding. It is rated 250-amps, 30-volts for DC welding and 300-amps, 30-volts for AC welding, both ratings on 100% duty cycle.

Multiple current from the generator is made possible by a stator which contains two windings, one for generating AC welding current and one for generating AC power current of single phase, 3-wire, 110/220 volts. The power current is fed directly to the power receptacles. The welding current is controlled by a tapped AC reactor and rheostat for AC welding. **Hobart Brothers Co., CE-2, Troy, Ohio**

Four Wheel Drive Tractor

THE PRODUCTION OF A LOW cost, four wheel drive tractor especially designed for light industrial and construction work and for farm use has been announced. Designated as the W4G062 Tractor, it is available in four different, hydraulically operated and ready equipped models; Bulldozer, Grader Clam, Roll Bucket and Loader.

New controlled differential steering

Available in Four Models

gives a turning radius of 12 in. in a 6 ft curb to curb circle. A four wheel drive system through 7.50x16 tires gives high flotation and plenty of extra traction. The operator is seated forward giving excellent visibility in the working area plus better operating balance. Other features include double acting hydraulic cylinder with float position valve and a new, fast service design that allows easy removal of clutch or transmission. **Detroit Tractor Ltd., CE-2, 1221 E. Keating Ave., Muskegon, Mich.**

EQUIPMENT MATERIALS and METHODS

(continued)

Double-Tapered Design

The addition of a new double-tapered shape to the company's line of bituminous hauling tanks has been announced. This new design offers positive center drainage with greater tank strength through the use of a conical cross-section

Positive Center Drainage

shape, giving the company a range of four different hauling tank designs. Previously available in the line were the regular tapered-shape design with rear drainage, the regular cylindrical-shape tank, and the straight oval tank. **E. D. Etnyre and Company, CE-2 Oregon, Illinois.**

Purge Meter Line

A new line of Glass Tube Purge Meters has been put into production. The design of these low capacity flow meters includes features which make them convenient and reliable in purge, liquid level control, or other applications.

The stainless steel purge meters are available in various sizes. Metering tubes are either 3-in. scale for easy reading, or 1½-in. scale for space saving. They give direct reading in gph of water or scfh of air. Except for the metering tube and frame, all purge meter parts are interchangeable, regardless of scale length. The metering tubes and floats cover a flow range of 0.01 to 30.0 gal of water per hour, or 0.12 to 125.0 standard cu ft of air per hour. **Wallace & Tiernan Inc., CE-2, 25 Main St., Belleville 9, New Jersey**

Traction Drive for Portable Elevator

A new model of portable personnel elevator with traction drive has been introduced. Unlike conventional drives, it does not require a counterweight or other type of dead weight suspended on the cable to maintain driving friction.

The advantage of the traction drive over the drum winding type is the elim-

(Continued on page 142)

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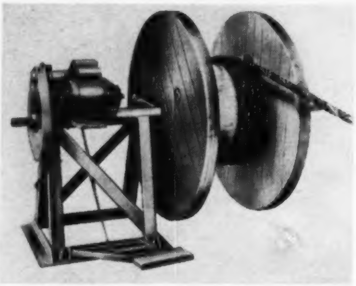
ination of the cable equalizing problems which arise on heights of 250 ft or more in drum winding equipment.

The elevator operating on a vertical monorail, made up of 10-ft sections of "H" beam, has a carrying capacity of eight men or 2000 lb. It is simple to set up and operate and can be dismantled, moved to another location and re-assembled in a few hours, a feature which makes the elevator ideal for industrial maintenance, oil refineries, public utilities, chemical plants, steel mills, storage elevators, railroads, mines, shipyards and dams. It is particularly suited for construction use by eliminating the need for ladders, scaffolds and stairways. **Hawkeye Products Corp., CE-2, 222 Dey Bldg., Iowa City, Iowa**

Heavy Duty Reeler and Coiler

ELECTRICALLY DRIVEN WITH COMPLETELY enclosed, oil immersed gear reducer, and economically built without sacrificing any of the convenience features of the most expensive machines, the Heavy Duty Reeler and Coiler has tremendous pulling power for reeling and coiling from the largest standard master storage reels.



Economically Built

The electric motor is the heavy duty capacitor type with 400% overload rating, 110/220 60 cycle single phase.

A 20-in. dia coiling head gives a rope speed of 89 ft per min allowing safe operation by an inexperienced person. The shaft is 2-in. dia for small reels, and two reel bushings are furnished for 5-in. arbor holes for all reels up to 38-in. dia, 2500 lb. **Sherman & Reilly, Inc., CE-2, First and Broad Streets, Chattanooga 2, Tenn.**

New Bottom Dump

THE DEVELOPMENT OF A new 35-ton capacity bottom dump trailer for use with the Caterpillar DW21 Tractor has been announced. Called the PW21, the new trailer offers many new design and performance advantages. It has a third (or rear) door in addition to two 3-ft wide bottom doors. The third door, together with steep side plate angles (18-deg off vertical) and a high, 5-ft rear clearance, permits the trailer to dump instantly with no "hang up" and allows the unit to ride out over—not through—the dumped load.

Primemover for the PW21 is the Caterpillar DW21 Tractor. The 23-yd (struck) capacity of the trailer and a 345-hp tractor give the unit exceptional gradeability and traction. Another feature is the hydraulically actuated door mechanism. Doors are locked, not merely closed, which relieves the hydraulic system of all load and haul road spillage is eliminated. They are closed by a hydraulic ram driving a cable take-up; when dumping doors can be opened instantly or slowly for spread dumping. **Athey Products Corp., CE-2, 5631 W. 65th St., Chicago 38, Ill.**

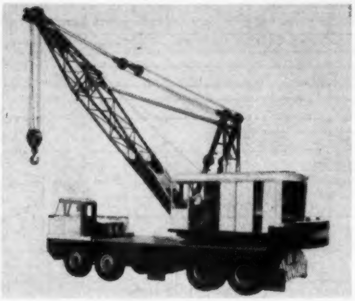
EQUIPMENT MATERIALS and METHODS

(continued)

Moto-Crane

THE INTRODUCTION OF A 65-ton Model MC-760 Moto-Crane on an all new carrier has been announced.

The carrier is constructed with a sturdy new welded box section chassis frame 22-in. deep, eliminating deflection or torsion



Model MC-760

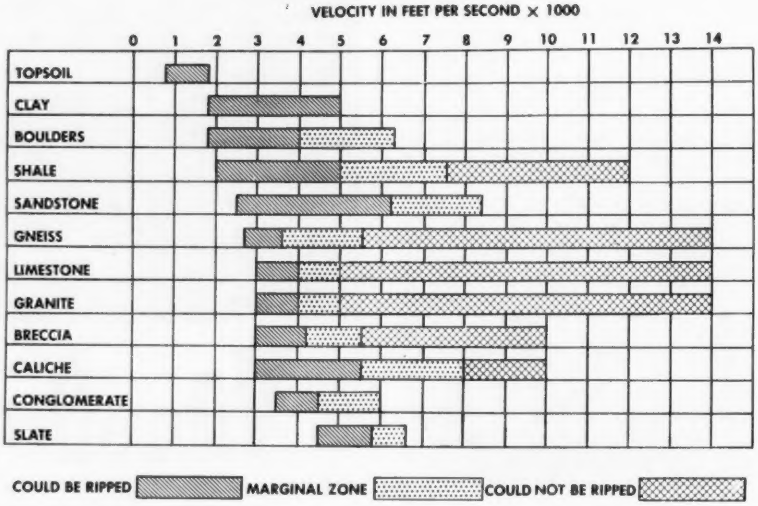
under the heaviest loads. The 230-in. wheel base provides 14 feet between the second and third axles, enough to meet the most stringent bridge formulae. The unit travels up to 37.6 mph and has air brakes on all 8 wheels. Front axles are mounted with solid equalizer beams to produce higher "on rubber" capacities. The two rear driving axles are double reduction type with Hi-traction differentials and final reduction is through planetary wheel hubs which relieve the power strain of excessive loads and shocks.

The Power-Set Outriggers can be extended to working position in less than 60 sec; they automatically adjust to rough terrain, level the machine, and are held in position by automatic wedge locks free of hydraulics. Quick-disconnects are provided so outrigger boxes and beams can be unpinned for reduced weight for highway travel. **The Thew-Lorain Co., CE-2, Lorain, Ohio.**

Revised Calculator

POCKET SIZE AND EASY to use, the PSI Calculator for concrete products has been completely revised and now includes instant conversion data from total load to psi on seventeen standard test specimens and masonry units ranging from 2-in. x 2-in. cubes and 3-in. x 6-in. cylinders to 12-in. x 16-in. and 12-in. x 18-in. masonry units. It will be mailed free to responsible individuals providing name, title and business affiliation. **Forney's Incorporated, Tester Div., CE-2, P.O. Box 310, New Castle, Pa.**

Seismic Analysis Determines Rippability



Most materials can be ripped with big tractors if conditions are right; the key to rippability seems to be consolidation of the material. Looking for a fast, inexpensive and accurate way to determine if the material could be ripped, before a tractor and ripper were moved in, the company's engineers developed the seismic analysis method to determine rippability. Sound waves travel through materials of different consolidations at different, predictable velocities. The velocity of the sound or shock wave through the subsurface material provides the answer to "can it be ripped?" Manufactured by Geophysical Specialties Company, Hopkins, Minn., the seismograph is lightweight, and contractor's personnel can learn to operate it in an hour.

Operating procedure is simple. An electronic counter works on self-contained batteries. A geophone plugs into one receptacle on the counter's face. A long wire goes into another receptacle and the other end of the wire connects to a spring contact switch on an 8-lb sledge. A small steel plate, when hit by the sledge, will produce a sufficiently strong wave for readings to 50 ft deep under most soil conditions.

Velocity (V) of the wave is found by the formula, $V = D/T$ where D is the distance from the plate to the geophone and T is the time lapse. This is plotted on a graph, with distance in feet along the bottom and time in milliseconds up the side.

Depth at which changes occur is computed by the formula

$$D = \frac{X}{2}\sqrt{\frac{V_2 - V_1}{V_2 + V_1}}$$

where D is depth, X is the distance along the bottom of the graph from zero to the intersection point of the lines, V_1 is the velocity of the seismic wave in the upper layer and V_2 is the velocity in the next lower layer. Depths of successive layers are determined in similar fashion. **Caterpillar Tractor Co., CE-2, Peoria, Ill.**

Foamglas Cellular Glass Blocks

The use of exterior columns as a means of gaining uninterrupted interior spaces in the 60-story Chase Manhattan Bank Building, New York City, posed the problem of the effect of severe temperature changes on the exposed columns.

The building towers 840 ft, and considerable expansion and contraction in the columns was anticipated. As these movements transmitted to the building structure could cause trouble, it was decided to cover the columns from the 30th floor up with a layer of Foamglas cellular glass blocks, attaching them to the columns with both spindle anchors and mastic; the columns were then finished with aluminum sheathing. The unique cellular glass material, being composed of millions of tiny, sealed glass cells, is unaffected by moisture and is dimensionally stable. **Pittsburgh Corning Corp., CE-2, One Gateway Center, Pittsburgh 22, Pa.**

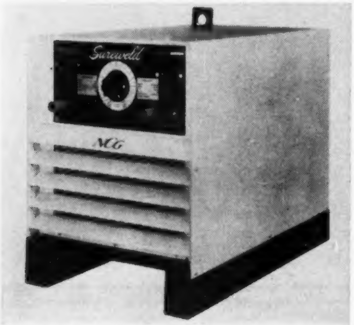
EQUIPMENT MATERIALS and METHODS

(continued)

All-Weather Welding Units

New arc welders completely weather-proofed against rain, cold, heat and even salt spray for use by ship builders, contractors and metal fabricators have been announced.

Protection from the elements includes: double-dipped Class B insulation on the high-quality transformers to provide maximum resistance to moisture and increased dielectric strength; fully sealed, semi-metallic rectifiers; totally enclosed, lifetime-lubricated fan motors with louvre-protected air intakes and exhausts; and Cam-Lok output terminals.



Completely Weather-Proofed

Some of the performance features are: a dual current range with a single rheostat, controlling output in each range; maximum arc stability because of a patented weld stabilizer, specially designed transformer and high open-circuit voltage; simple, safe and inexpensive hand or foot low-voltage remote control units; and horizontal type cabinet construction to facilitate stacking of units and the saving of floor space. **National Cylinder Gas Division of Chemetron Corp., CE-2, 840 North Michigan Ave., Chicago 11, Ill.**

Self Trailing Roller

Hydraulic operation of self-trailing wheels for maximum portability is offered by the new model 650-C two wheel tandem roller. Weighing from 4½ to 6½ tons the tandem increases the number of the company's tandem rollers available to 15 models and offers self-trailing for the size roller most normally requiring portability. During rolling operations, the travel wheels are retracted upward to a high position, offering maximum clearance. For the few instances where close wall clearances are necessary, the travel wheels can

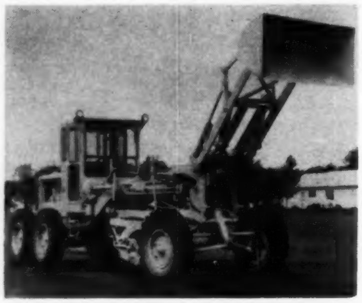
(Continued on page 146)

be quickly and easily removed. Heavy steel construction and positive 3-way wheel support lock ensures maximum safety during all types of trailing situations. **Essick Manufacturing Co., CE-2, 1950 Santa Fe Ave., Los Angeles 21, Calif.**

The GraderloadeR

DESIGNED FOR OPERATOR CONVENIENCE, a new one cu yd shovel-loader attachment for Caterpillar Motor Graders mounts on the front of the grader, allowing full-vision operation during loading or dumping.

Once the mountings are added to a grader, the "GraderloadeR" can be easily installed or removed in minutes. Using existing connection points on the grader, the machine quickly attaches to the top and forward scarifier mounts. Two bolts and a transverse pin secure the unit to the grader frame without interfering with grader operations. Because of its front mounting, the bucket can be seen by the operator at all times, without turning



Allows Full-Vision Operation

around in the seat. Mounting pins with built-in grease reservoirs are used at all points of movement to insure long life and reduced metal wear, and quick-connect hydraulic couplings are used for fast line hook-up.

The equipment was designed for fast loading of excess handling, backfilling, snow removal and general stockpiling. **Martin Company, CE-2, 620 Andrews Ave., Kawanee, Ill.**

New Orleans Convention of ASCE

Jung Hotel, New Orleans, La., March 7-11, 1960

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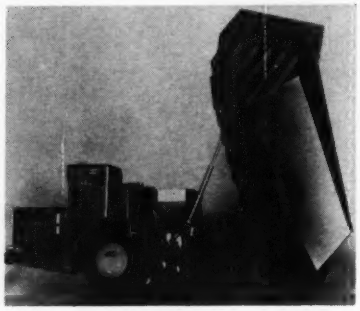
Diesel Electric Ore Truck

A NEW 55-TON PAYLOAD diesel electric ore truck for open pit mining and large-scale construction operations, has been designed to cut haulage costs 10 to 30%.

The vehicle will incorporate the GE motorized wheel drive, completely eliminating the need for axles, transmissions, differentials, and drive shafts. Each wheel has its own integral electric motor and simple gear drive arrangement. Delivery of maximum engine horsepower to all wheels enables the truck to take steeper grades (up to 15%), cutting haul length



55-Ton

and reducing roadway maintenance expense.

Dynamic braking on all four wheels, utilizing the full horsepower capacity of the wheel motors as generators, is another important feature of the ore hauler. The energy of motion of the vehicle is dissipated into air-cooled resistors during the braking cycle. Fully modulated braking control permits the operator to handle the fully loaded truck smoothly and easily throughout the entire speed range without any mechanical wear or fading. **Unit Rig & Equipment Co., CE-2, P.O. Box 1889, Tulsa 1, Oklahoma.**

Power Buggy

A NEW MODEL OF the "Walk-or-Ride" Power Buggy (R) features an automatic speed changer which varies the drive ratio automatically to give greater pulling power, or greater speed, as needed, the load moving faster.

This ingenious speed changer is variable and completely automatic, according to the manufacturer. When the buggy hits an uphill pull, a lower drive ratio (down to 1:2½) automatically takes hold for extra pulling power. When the going is easier and faster, it moves automatically into a higher drive-ratio (up to 2:1) for higher speeds: the only gear shifting is for reverse. **Whiteman Manufacturing Company, CE-2, 13020 Pierce St., Pacoima, California**

Films Available

SELECTED MOTION PICTURES—Association Films' 1959-'60 catalog of "Selected Motion Pictures" has just been published and is available free of charge to interested community organizations. The 44-page catalog describes over 500 free and rental 16mm motion pictures offered to the community for classroom, club and organization showings. **Association Films, Inc., CE-2, 347 Madison Ave., New York 17, N. Y.**

"A COUNTY BUILDS SOIL-CEMENT"—A new film which will be of great value to engineers has been made available. Entitled "A County Builds Soil-Cement", the movie shows how a county can plan and carry out a sound county paving program. **Portland Cement Association, CE-2, 33 W. Grand Ave., Chicago 10, Ill.**

FIRE GUARD CEILING—A 16mm sound motion picture explains how it is possible to achieve rated fire protection for steel supporting members or metal decks by using a new prefabricated acoustical tile ceiling called Armstrong Acoustical Fire Guard. The ceiling not only sound conditions, but also serves as an efficient fire barrier, requiring no additional fire protection above the ceiling. **Armstrong Cork Co., CE-2, Dept. I. S., Lancaster, Pa.**

"ARC WELDING ELECTRODE SELECTION"—This 25-min 16mm full color film discusses the basic factors which are important for correct electrode selection. It outlines a step by step procedure that covers base metal identification, welding currents, welding positions, thickness and shape of base metal to be welded, joint design and fit-up, service conditions, production efficiency and environmental and job conditions. **Hobart Brothers Co., CE-2, Troy, Ohio.**

"REVOLUTION ON WHEELS"—A new full-color 16mm sound movie about the Haulpak off-highway trucks has just been released. It graphically illustrates the many revolutionary features and advantages of the Haulpak line. One scene at a Midwestern limestone quarry shows the Haulpak's extreme maneuverability. **LeTourneau-Westinghouse Co., CE-2, 2301 NE Adams St., Peoria, Ill.**

SEWAGE LIFT STATIONS—The company's first motion picture on factory-built sewage lift stations has been produced. The introductory scenes tell the story of the postwar boom in suburban housing and the related need for new facilities, new products and new techniques of construction. The operation of the pump station is pointed out by animation. **Smith & Loveless, Inc., CE-2, Lenexa, Kansas**

Literature Available

Smoothweld Steel Tubing—A new two-color, four-page technical bulletin describing Smoothweld steel tubing is now available. The brochure discusses the application of Smoothweld steel tubing systems to replace screwed or welded piping. Smoothweld tubing is soldered or silver brazed without the need of separate couplings to provide low-cost "one-piece" systems. **The Standard Tube Co., CE-2, 24450 Plymouth Road, Detroit 39, Michigan**

Bridge Deck Vibrating Screed—A new technical bulletin has just been published on the "Advantages and Use of the Vibrating Screed". It has compiled detailed information on the latest techniques and equipment for striking off concrete surfaces by vibration screeding. A large number of illustrations are included showing the use of the Vibrating Screed on bridge decks, floors and highways. **Stow Manufacturing Co., CE-2, 93 Shear St., Binghamton, New York**

Calcore Panel Curtain Wall—An 8-page booklet on Calcore panel curtain wall is now available. It includes detailed information in sixteen basic plane types, plus full-color illustrations of recent major Calcore installations. Caloric's new Plasti-Cal, a plastic synthetic material that has wide application in laminated panels, wall, and room dividers and building products, is also described in the booklet. **Architectural Division, Caloric Appliance Corp., CE-2, Topton, Pa.**

Gurley Ephemeris—Now available to practicing surveyors and engineers and to instructors and students of surveying, the 1960 Gurley Ephemeris contains charts showing Northern, Southern and Equatorial stars. Bound-in charts for simplifying the computation of Polaris are included. **W. & L. E. Gurley, CE-2, Station Plaza, Troy, N. Y.**

Concrete Handbook—A handbook showing the various concrete properties in graph form and how these properties are affected by reducing the water-cement ratio by means of vacuum extraction has been published. **Vacuum Concrete, Inc., CE-2, 1010 Girard Trust Bldg., Philadelphia 2, Pa.**

Multi-Arc Welding—Technology, economics, and other practical aspects of multi-arc welding are treated comprehensively in this 71-page illustrated "Guide to Better Welding". Principles, uses and advantages of multi-arc welding are explained, with references to specific examples. The publication compares initial operating and maintenance costs of multi-arc and single-operator welding under varying conditions. **J. B. Nottingham & Co., Inc., CE-2, 441 Lexington Ave., New York 17, N. Y.**

Pumps—This 8-page catalog describes horizontally split case double suction pumps for medium and high head service. Series arrangements and vertical mountings are illustrated, along with regular mountings. **C. H. Wheeler Mfg. Co., Economy Pump Div., CE-2, 19th and Lehigh Ave., Philadelphia 32, Pa.**

Post-Tensioning—A 16-page engineering data bulletin, 70-6, describes force development calculations, detailing and placement plans, tendon and anchorage assemblies, stressing and grouting equipment, and field labor procedures for cast-in-place and pre-cast post-tensioned concrete construction. **Jospeh T. Ryerson & Son, Inc., CE-2, Box 8000-A, Chicago 80, Ill.**

Aircomatic Welding Wires—A newly revised edition of the Aircomatic Welding Wire Pocket Guide has just been published. This handy, 84-page booklet has been brought up to date to include the latest information on the company's complete line of gas-shielded metal-arc welding wires, including data on the improved A675 Steel wire, and the new A666 Steel and A556 aluminum. **Air Reduction Sales Co., CE-2, 150 E. 42nd St., New York 17, N. Y.**

DragScraper and Cableway Systems—A new 16-page brochure covering the handling of ores, sand and gravel, chemicals and other bulk materials by Sauerman machines is offered. Four pictorial sections show DragScraper and Cableway applications for excavating and hauling; storage and reclamation; and engineering and construction. **Sauerman Bros., Inc., CE-2, 620 S. 28th Ave., Dept. C-15, Bellwood, Ill.**

Sewage Surge Relief Valve—Bulletin Sew-1 describes a new Sewage Surge Relief Valve. Designed to prevent damage from overpressure in sewage lines, the new valve opens immediately and automatically whenever the line pressure exceeds a predetermined setting. When the pressure returns to normal the valve is slowly "cushioned" to the tightly closed position. The brochure illustrates how the new valve gives full pipe flow with minimum interference. **Golden-Anderson Valve Specialty Co., CE-2, 1207 Ridge Ave., Pittsburgh 33, Pa.**

From the MANUFACTURERS

MERGER ANNOUNCED: The merger of Pittsburgh-Des Moines Steel Co. and Hammond Iron Works has been announced . . . **HEADQUARTERS MOVED:** The Chicago headquarters of Fairchild Aerial Surveys, Inc., has been moved from 111 West Washington Street, Chicago 2, Ill., to the Daily News Plaza, Rm. 1904, 400 West Madison St., Chicago 6, Ill. . . . **DATACENTERS:** Scientific and engineering organizations can now rent time by-the-hour on powerful International Business Machines Corp. 709 computers at Datacenters in midtown New York and Poughkeepsie, N. Y. The more than $2,500,000 large-scale 709 system offers very rapid, low-cost processing of scientific as well as business data . . . **NEW DIVISION:** Paragon-Revolute Corp., Rochester, New York, manufacturer of blue printing and allied reproduction equipment, has become a division of the Charles Bruning Co., Inc., Mount Prospect, Ill. . . . **DISTRIBUTORS APPOINTED:** Bludworth Marine Division of Kearfott Co., Inc., has announced that its service and parts supply will be carried on by States Electronics Corp. as an independent operation . . . Standard Refractories Ltd. with offices in Hamilton and Toronto, Ontario, Canada, has been appointed distributor for J. H. France Refractories Co., Snow Shoe, Pa. . . . **EXPANDED FACILITIES:** Plans for a $4,000,000 expansion of earthmover tire production facilities at Goodyear Tire & Rubber Company's Topeka, Kansas, plant were announced. Tire building equipment will be installed in a new building, measuring 350 ft by 100 ft, by 1961 . . . **COOPERATIVE RESEARCH PROGRAM:** A cooperative research program on water flooding and crude oil production and refining problems was announced jointly by Magna Products, Inc., Santa Fe Springs, Calif., and the Chemical Division of General Mills, Inc., Kankakee, Ill. . . . **SUBSIDIARIES FORMED:** H. K. Porter Co., Inc., diversified Pittsburgh, Pa. industrial company, has established a world-wide marketing and distributing subsidiary in Geneva, Switzerland, to be known as H. K. Porter & Cie., S. A. . . . Keuffel & Esser Co. officials have announced the establishment of Keuffel & Esser of Colorado, Inc., a new subsidiary branch in Denver, Colorado . . . **ACQUIRES RIGHTS:** Mark B. Owen, Vice President, announces the acquisition by Nichols Engineering and Research Corp., 70 Pine St., New York City, of the exclusive manufacturing and sales rights in the United States of the Equipment Development Company's "Roto Plug" Sludge Concentrator . . . **COMPANY FORMED:** Formation of Harbison-Carborundum Corporation by Harbison-Walker Refractories Company, Pittsburgh, Pa. and The Carborundum Company of Niagara Falls, New York was announced. Harbison-Walker, world's largest refractories manufacturer, and Carborundum, a principal factor in the abrasives market and a leader in the manufacture of super refractories, will pool their advanced refractories technology and sufficient financial resources to establish a jointly owned subsidiary for the engineering, manufacture and sale of fused refractories . . . **RETIREMENT:** William C. Lytle has retired as vice president of Atlas Powder Company after a diversified career spanning almost all of the company's history . . . **RESIGNATION ANNOUNCED:** Walter A. Hensel, Vice President of General Aniline & Film Corp. and General Manager of its Ozalid Division has announced his resignation . . . **BUELL ACQUIRES NORTHERN BLOWER:** Buell Engineering Co., Inc., one of the nation's leading producers of electrical and mechanical dust collecting equipment has purchased the 49-year-old Northern Blower Company (Norblo) of Cleveland, Ohio. Under the terms of the acquisition, L. A. Eiben will operate The Northern Blower Division of Buell as a vice president within the framework of the Buell organization. Norblo manufactures bag-type dust collectors and filtering equipment . . . **APPOINTMENTS:** Arthur B. Horton was elected board chairman of Chicago Bridge & Iron Co. at a recent meeting of the board members in Chicago. . . . Gary Cass, Chicago sales engineer for Universal Form Clamp Co., has recently been named Assistant Sales Manager.

PROCEEDINGS AVAILABLE

December

2314. Analysis of Continuous Trusses by Carry-Over Moments, by Jan J. Tuma. (ST) A general procedure for the analysis of continuous trusses subjected to stationary or moving loads is presented.

2315. Suggested Legislation on Flood Plain Regulation, by Joseph I. Perrey. (HY) If communities are to regulate the use of flood plains in a manner that will tend to reduce the damage from floods, statutory authority must be provided.

2316. Improved Tunnel Spillway Flip Buckets, by T. J. Rhone and A. J. Peterka. (HY) This paper considers several buckets, of the type used to deflect or flip tunnel spillway discharges in terms of their desirable or undesirable features.

2317. Tidal Characteristics from Harmonic Constants, by Bernard D. Zetler. (HY) Harmonic analysis of tide observations determines harmonic constants (amplitudes and epochs) of the harmonic constituents of the tide.

2318. A Case of Critical Surging of a Moored Ship, by Basil W. Wilson. (WW) An analysis is made of the circumstances in which an oil tanker developed critical surging motions and broke adrift after rupture of its mooring lines.

2319. Permafrost Aspects of Hudson Bay Railroad, by J. L. Charles. (SM) Factors conducive to causing the condition of permafrost, the possible extent of this condition in northern Canada, and its effect on construction and maintenance are described.

2320. Linearly Variable Load Distribution on a Rectangular Foundation, by Aris C. Stamatopoulos. (SM) The vertical stresses and surface displacements caused by a rectangular linearly variable load distribution applied at the level surface of an idealized body are given in terms of equations and charts.

2321. Vierendeel Bents with Nonprismatic Members, by S. L. Lee and F. P. Wiesinger. (ST) Inclined-chord Vierendeel bents with members of variable section are analyzed by means of a modified moment-distribution procedure in which the equilibrium between the internal forces in the chord members and the external forces is maintained throughout the entire distribution operation.

2322. Computer Design of a Multistory Frame Building, by A. M. Lount. (ST) The selection and justification of design method used (moment distribution), procedures, and examples are presented.

2323. Discussion of Proceedings Paper 1799. (HW) Vedat A. Verlici closure to 1799.

2324. Discussion of Proceedings Paper 2048, 2055. (CP) Nathan Cherniack on 2048. R. A. Haber and W. J. Miller, Jr., George H. Herrold on 2055.

2325. Discussion of Proceedings Paper 1732, 2062, 2135. (SM) T. H. Wu on 1732. J. L. Sherard on 2062. Michael Praszker, Morris Grosswirth on 2135.

2326. Discussion of Proceedings Paper 2067, 2068, 2171. (WW) Basil W. Wilson on 2067. A. F. Benscheidt on 2068. Robert Y. Hudson corrections to 2171.

2327. Discussions of Proceedings Paper 1963, 1964, 2059, 2154, 2156, 2158. (IR) Wayne D. Criddle and R. Keith Higginson, C. P. Christopoulos, W. C. Munson, G. Marvin Litz on 1963. A. R. Robinson, R. H. Brooks on 1964. M. R. Lewis, Robert O. Thomas, S. T. Harding on 2059. M. Maasland on 2154. M. Maasland on 2156. M. Maasland on 2158.

2328. Discussion of Proceedings Paper 1734, 1737. (PO) G. H. Condit on 1734. C. M. Roberts on 1737.

2329. Discussion of Proceedings Paper 1942, 2005, 2037, 2218, 2221. (ST) Edward Y. W. Tsui closure to 1942. H. L. Su on 2005. Charles O. Heller on 2037. Ming L. Pei corrections to 2218. John Sherman corrections to 2221.

2330. Standard Factories in Europe, by Sigurd Grava. (CP) The European practice of erecting standard factories is advanced as a solution to the industrial slum problem.

January

Journals: Engineering Mechanics, Hydraulics, Sanitary Engineering, Structural

2331. Electrical Analog Computer for Limit Design of Structures, by M. Zaid and F. L. Ryder. (EM) An analog computer capable of minimizing a linear function subject to large numbers of linear inequalities is described. This is the situation customarily encountered in the "limit design" problem. The operation of the computer is described with the aid of the customary n-space geometric analogy.

2332. Comparative Study of a Segmental Arch Ring, by O. C. Zienkiewicz (EM) Three commonly used systems of shell equations are employed to solve the case of hydrostatic pressure acting on a segmental arch ring. The results are compared with solution by classical approach and a modified classical approach. Serious limitations of Donnell's equations are discovered and the nature of the differences between Flügge's and Timoshenko's equation elucidated.

2333. Relaxation Theory of Creep of Metals, by Francis H. Ree, Taikyue Ree, and Henry Erying. (EM) A model is proposed for explaining secondary creep at high temperatures. Applying rate-process theory to this model, an equation for secondary creep rates is derived. This equation is applied with good results to creep of aluminum, aluminum base alloys, and nickel.

INSTRUCTIONS

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4. Papers should be ordered by serial number. The member should keep a record of papers ordered to avoid unwanted duplication.

5. Non-members of the Society may order copies of Proceedings papers by letter with remittance of 50¢ per copy; members of Student Chapters, 25¢ per copy.

Standing orders for all Papers in any calendar year may be entered at the following annual rates: Members of ASCE, $15.00; members of Student Chapters, $15.00; non-members, $40.00; libraries, $25.00.

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(PO) Power
(PP) Professional Practice
(SA) Sanitary Engineering
(SM) Soil Mechanics and Foundations
(ST) Structural
(SU) Surveying and Mapping
(WW) Waterways and Harbors

2334. Deflection Stability of Frames Under Repeated Loads, by E. P. Popov and R. E. McCarthy. (EM) Experimental results on the behavior of three portal-type structural steel rigid frames are reported. One such frame was subjected to a proportional loading; another, to repeated lateral loading causing alternating plasticity in one of the members; and the third, to repeated lateral loading causing incremental collapse of the frame.

2335. Early History of Hydrometry in the United States, by Steponas Kolupaila. (HY) The history of hydrometry (stream flow measurements) is reviewed and its achievements in science and engineering are examined.

2336. A New Approach to Local Flood Problems, by Herbert D. Vogel (HY) The paper describes the growing pressures of population and urban growth which increase encroachment on the flood plain, thereby increasing flood damage potential. TVA experience in identifying flood-danger areas of cities and encouraging local action to guide urban development away from these areas is reviewed.

2337. Travelling Loads on Rigid-Plastic Beams, by P. S. Symonds and B. G. Neal. (EM) The problem of a rigid plastic beam crossed by a load too large for the beam to support statically is examined. The major consideration is whether or not there is a critical magnitude of the travelling load, above which the crossing cannot be made at any finite speed without causing total plastic collapse. The present study indicates that a critical load will not be obtained if the mass of the beam is taken into account.

2338. Design of Circular Plates Based on Plastic Limit Load, by L. W. Hu. (EM) Load carrying capacities of circular plates subjected to axially symmetrical loading were determined by plastic analysis. Design charts for nine cases of loading were constructed. An example was given to illustrate the use of the charts for the design of a pressure vessel.

2339. Generalized Distribution Network Head Loss Characteristics, by M. B. McPherson. (HY) The analysis of complex distribution systems can be expedited by means of principles developed in this paper. Head losses over a wide range of demand and equalizing storage rates can be calculated directly, based on only two or three complete network analyses, under design assumptions employed in normal practice.

2340. The Fourth Root n-f Diagram, by T. Blench. (HY) A friction-factor design diagram, the "fourth root n-f diagram," is presented as an alternative to the Moody Diagram for engineers who prefer to use the Manning equation for the boundary condition called "rough." Essentially, this design diagram is a Moody diagram in which the logarithmic basic phase lines have been linearized, the set of transition curves for one type of boundary material has been replaced by a few samples for several types, the set of linear "rough boundary" lines has been collapsed into one, and a special line has been added to relate Manning's *n* to roughness height.

2341. Aerobic Metabolism of Potassium Cyanide, by John B. Nesbitt, H. Robert Kohl and Elmer L. Wagner, Jr. (SA) In an activated sludge system, in which no mixed liquor suspended solids were wasted and in which CN- served as the only source of carbon and nitrogen, it was found that (1) more than 99% of the CN- was metabolized, (2) suspended solids were maintained, (3) approximately 98% of the cyanide-carbon was converted to CO_2, and (4) from 75% to 90% of the cyanide-nitrogen was converted to ammonia, nitrite, and nitrate.

2342. Commentary on Plastic Design in Steel: Compression Members, Lynn S. Beedle, chmn. (EM) This paper is the fifth in a series of reports on plastic design deriving from a joint committee of WRC and ASCE. The paper discusses the influence of axial force, column instability, rotation capacity, lateral-torsional buckling and frame instability on the plastic analysis and design of rigid frames. The background of research is described, experimental correlation with theory is given, and approximations for design use are discussed.

2343. Role of Price in the Allocation of Water Resources, by Lawrence G. Hines. (SA) This paper examines the price-cost function in the allocation and utilization of water resources in the United States and analyzes (1) the market valuation process, (2) the factors affecting the determination of municipal water rates, and (3) the shifts of costs that result from different water uses.

2344. Orthogonal Gridworks Loaded Normally to their Planes, by Ignacio Martin and Jose Hernandez. (ST) The torsional rigidity of the bars should be taken into consideration in this solution of a gridwork, since its behavor is similar to a two-way slab. The solution presented for this problem, which generally is highly indeterminate, allows the introduction of prestressing forces. A set of simultaneous slope-deflection-gyrations equations is established to be solved by the electronic computers now available. A prestressed concrete deck, 177 ft by 177 ft with beams spaced 10.8 ft apart in each direction, has been solved by this method.

2345. Summary of the Activities of the Column Research Council, by Bruce G. Johnston. (ST) The summary briefly outlines the administrative setup of the Column Research Council, organized in 1944. The work of the council in reviewing world literature on metal compression members is reviewed and it is shown how the various objectives of the council, as originally framed, have been met during the past 15 years.

2346. Continuous Girder Bridge with Variable Moment of Inertia, by Sabri Sami. (ST) The purpose of this presentation is to develop and illustrate a simplified procedure for the analysis of symmetrical two and four-span continuous girder bridges with variable moments of inertia. The method developed consists of substituting values related to the bridge dimensions, proportions and loadings, into formulas giving the magnitudes of the redundants without the necessity of a sign convention. All constants, coefficients, and functions are dimensionless so that any consistent system of dimensions may be used.

2347. The Shell Vault of the Exposition Palace, Paris, by Nicolas Esquillan. (ST) General requirements for the structure are given; the preliminary and final designs are described and the function of structural elements is explained; principles of design, strength of materials, allowable stresses and forces affecting the roof design are presented; and the investigation of local and general buckling of the shells, the influence of creep and other factors on the stability of the shell vault are detailed.

2348. Discussion of Proceedings Paper 1879, 1898, 2092, 2094, 2096. (EM) Lawrence P. Johnson, Jr. and Herbert A. Sawyer, Jr. closure to 1879. Charles C. Bowman and Vaughn E. Hansen closure to 1898. Hsuan-Loh Su on 2092. E. Rosenblueth on 2094. A. M. Neville, Keith Jones on 2096.

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